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COMMONWEALTH MYCOLOGICAL INSTITUTE

REVIEW
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C. A. B.
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FILE

WENZL (H.). **Der Fadenkeimigkeits-Abbau der Kartoffel.** [Spindle sprout degeneration of Potato.]—*PflSchBer.*, 15, 1–3, pp. 8–18, 1 graph, 1955. [English summary.]

After further investigation at the Austrian Federal Experiment Stations, potato degeneration [cf. *R.A.M.*, 34, p. 244; 35, p. 223] may be ascribed, in the light of present knowledge, either to tuber-transmissible virus diseases or to spindle sprout degeneration, which assists the development of wilt (*Colletotrichum atramentarium*) [see following abstracts] and leads in turn to the production of further spindle sprout disease.

Recent findings on the increase of wilt owing to sparseness of stands should be taken as valid only for the dry regions of Austria, but similar conditions probably prevail in adjacent territories of Hungary and Czechoslovakia. In trials during 1953 and 1954 one half of the experimental plots were planted normally, the other half being planted at one third of the normal rate. The plants developed well in the moist early summer, but the dry heat of August and September caused considerable wilt. The percentage of diseased plants was 10·6 with normal spacing and 33 in those thinly planted which, however, produced a yield 41 per cent. of the normally spaced, rather than the expected one-third, owing to better lateral development. The percentage of rubbery tubers was 6·22 for thin stands as against 2·49 for normal. In two similar trials in 1954 the percentages of wilted plants were 11·1 and 10·1 for normal, compared with 29·2 and 23·9 for thin stands.

Applications of straw mulch to heavy soil in 1953 (200 kg. two-year-old straw per 100 sq. m.) reduced the percentage of wilted plants from 4·5 to 0·97, increasing the yield by 11·6 per cent. and the number of normal-sized tubers by 14·3 per cent., while reducing the percentage of spindle sprout tubers from 30·2 to 26·2 in comparison with non-mulched controls.

The use of the term spindle sprout does not necessarily imply a progressive decrease in yield, for its influence on wilt depends largely on external conditions, and only when wide spacing is a major factor does it assume an adverse rôle. Its effect generally is less than that of tuber-transmitted viruses, but since these appear to be more damaging in incomplete stands, spindle sprout may indirectly increase their effect. The possibility of recognizing spindle sprout in germinated tubers affords a simple, practical means of control of this type of progressive degeneration by roguing the sprouted tubers before planting.

WENZL (H.). **Bodenstruktur, Salzgehalt und Colletotrichum-Welkekrankheit der Kartoffel.** [Soil structure, salt content, and *Colletotrichum* wilt disease of Potato.]—*PflSchBer.*, 15, 4, pp. 49–60, 1955. [English summary.]

After a review of the recent literature the author discusses his observations on soil salts and their influence on the incidence of *Colletotrichum atramentarium* on

potato [see preceding and next abstracts]. No evidence was found that the soil surrounding the roots of wilt-infected potato plants was enriched with soluble salts. Whereas the salt content of individual potato plants varied greatly, examination of 400 pairs of neighbouring plants (one healthy and one diseased) showed the salt content of each pair to be practically identical. A small difference (1·6 per cent.) in average electrical conductivity proved on closer examination not to be significant. In a number of plots the soil surrounding the roots of a considerable proportion of diseased plants was found to be hardened and crusted; this is assumed to be an effect of lack of shade, rather than a cause of wilt. Fertilizer, including trace elements, and carbon disulphide applications failed to reduce the incidence of wilt.

Wenzl (H.). **Unreifrodung als Maßnahme gegen Welkekrankheit und Fadenkeimigkeit.** [Premature lifting as a measure against wilt disease and spindle sprout.]—*PflSchBer.*, 14, 10, pp. 154–157, 1955. [English summary.]

Experiments at the Gutenhof and Fuchsenbigl experimental stations, of the Federal Plant Protection Institute, Vienna, showed that the early lifting of potato tubers significantly reduced the number of haulms infected with wilt disease (*Colletotrichum* [*atramentarium*]) and spindle sprout [*R.A.M.*, 34, p. 244 and preceding abstract]. The crop loss, however, amounting to approximately one third of the normal yield, due to the smaller size and number of lifted potatoes, was higher than the gain in healthy tubers, and the practice is therefore not economic.

Waggoner (P. E.) & Taylor (G. S.). **Experiments in the control of Verticillium wilt of Potatoes in Connecticut 1954.**—*Amer. Potato J.*, 32, 5, pp. 168–172, 1955.

Field trials on the control of potato wilt (*Verticillium* [*albo-atrum*]) were carried out in Hartford County and at the Experimental Farm, New Haven, on replicated 15 ft. single row plots of Kennebec. The following treatments were applied 40 days after planting, namely, a spray of 1,000 p.p.m. sodium salt of 2,4-D; four weekly sprays of 500 p.p.m. terramycin hydrochloride; a combined spray of 2,4-D and terramycin; and four weekly sprays of HD 469; in addition, cut seed was dipped for five minutes in 3,400 p.p.m. zineb (dithane Z-78), and four gals. of 3,250 p.p.m. zineb were poured into trenches on either side of the hills.

The 2,4-D by itself caused distortion and a consequent 17 to 25 per cent. reduction in yield, but there was recovery and wilt was significantly decreased in two commercial fields, and slightly in a severely diseased experimental field, though not at all in a similar but moderately diseased field. The other treatments had no effect, nor did a number of seed treatments with zineb, semesan bel, manzate, vancide and LO–738. It is suggested that growth regulators may prove suitable chemotherapeutants for *Verticillium* wilt.

Mezzetti (A.) & Tinarelli (A.). **Controllo sanitario in coltivazioni di Patata da tuberi originari. Prove comparative istituite dal Consorzio Agrario Provinciale di Bologna nel 1952.** [Health survey of plantings of seed Potatoes. Comparative tests instituted by the Provincial Agricultural Association of Bologna in 1952.]—*Ann. Sper. agr.*, N.S., 8, 3, pp. 669–708, 9 figs., 1954. [English summary.]

In 1952, at the request of the Agricultural Association of Bologna, the Experimental Laboratory of Plant Pathology and the Centre for Potato Research, Bologna, surveyed three exhibition seed-potato fields in Emilia, planted, respectively, with early, mid-season, and late varieties from many different countries.

In the three fields taken as a whole, incidence of internal brown spot [internal rust spot: *R.A.M.*, 25, p. 275; 34, p. 395] appeared to vary with date of lifting and the stage of development reached by the tubers at the time when the prevailing

climatic conditions favoured an outbreak. Hot, dry weather at the end of spring and the beginning of summer was found to be conducive to this trouble.

The incidence of a condition resembling hollow heart [34, p. 283] and heart necrosis [17, p. 548] amounted to 26 per cent. in the S. Michele variety. The information at present available on these diseases is reviewed and the authors consider that the two conditions, while resembling each other in some respects, are essentially different, hollow heart being, probably, a heterogeneous complex of physiological disorders, whereas heart necrosis is hereditary. In the fields surveyed, however, the two conditions could not be distinguished at sight.

An apparently new type of leaf malformation, present during May in all three fields, was characterized by an inhibition of axial elongation without any proportionate reduction in the superficial enlargement of the blade, resulting in ridges converging towards the tip with crinkling and dwarfing. The symptoms resembled those of the leaf roll or rugose mosaic virus but it is believed that the condition may be due to insect injury.

GOTO (K.), SUZUKI (N.), KONDO (S.), & MIYAJIMA (M.). **On the soil infection of blackrot of Sweetpotato and its transmission by fieldmouse.**—*Bull. Div. Plant Breed. Cult. Tokai-Kinki agric. Exp. Sta.*, 1, pp. 138–150, 4 figs., 2 graphs, 1954. [Japanese, with English summary.]

Further investigations on the transmission of black rot [*Ceratocystis fimbriata*: *R.A.M.*, 33, p. 111; 34, p. 541 and next abstract] of sweet potato [? at the Tokai-Kinki Agricultural Experiment Station, Ogoso, Japan] have shown that most field infection takes place through wounds inflicted by feeding animals, of which by far the most important is the field mouse (63 to 90 per cent.). The pathogen survived passage through the animal and was thus dispersed. It remained viable in dung for 2 months. It was found in the soil up to 24 cm. from diseased roots. A mouse fed on a diseased root one day could still transmit the disease to a healthy root the next day. The severity of black rot in the experimental field was directly proportional to mouse injury. The pathogen survives for one year, but not two, in an infested field but is not very active on the newly planted seedlings.

URITANI (I.), AKAZAWA (T.), & FUNAHASHI (S.). **Increased respiration in diseased plant and phosphorylation.**—*Symp. Enzyme Chem. (Japan)*, 10, pp. 174–182, 1954. [Abs. in *Chem. Abstr.*, 49, 22, col. 16078 *d*, 1955.]

In studies at Nagoya University, Japan, the infection of sweet potatoes by *Ceratostomella* [*Ceratocystis*] *fimbriata* [*R.A.M.*, 34, p. 395] increased respiration to an abnormal extent, but there was no corresponding enhancement of phosphorylation. The uncoupling of the two processes was effected by ipomeamarone [loc. cit.] formed in the injured cells, which stimulated respiration in the host and inhibited it, and also phosphorylation, in the fungus. The chemical and physical changes induced in the protoplasm by the penetration of *C. fimbriata* resulted in increased metabolism in the surrounding cells. Cytochrome and polyphenol oxidases and malic dehydrogenase were activated, while the respiration rate increased independently of phosphorylation through the activation of adenosinetriphosphatase and the formation of ipomeamarone. Large quantities of sugars were decomposed and formed many intermediates yielding various disease-resistant substances, such as polyphenols, coumarin, and other essential oils.

AKAZAWA (T.) & URITANI (I.). **Respiratory increase and phosphorus and nitrogen metabolism in Sweet Potato infected with black rot.**—*Nature, Lond.*, 176, 4492, pp. 1071–1072, 1 graph, 1955.

Further studies in the Laboratory of Biochemistry, Nagoya University, Japan, on sweet potato plants infected with black rot (*Ceratostomella* [*Ceratocystis*]

fimbriata) [*R.A.M.*, 34, p. 247 and preceding abstract] revealed that in contrast to the constant respiration rate in the [uninoculated] control and a uniform rate of increase (about 80 to 90 per cent.) in tissues treated with 2,4-dinitrophenol, the increase in infected tissue reached a maximum (90 to 100 per cent. increase) at 48 to 72 hours and then decreased gradually. In the control both inorganic and acid-soluble organic phosphate fractions remained almost constant, but in the infected tissue the former decreased initially, increased, and dropped again, with a concomitant increase in the latter fraction. Therefore the respiratory increase may be linked with the activated phosphate system. A further series of experiments demonstrated the synthesis of functional proteins such as mitochondria. The mechanism of the respiratory increase is explained as follows. On penetration of the tissues by *C. fimbriata* the protoplasm of the adjacent sound part is activated to synthesize organic phosphate and functional proteins, simultaneously accelerating the adenosine phosphate reaction and causing an increase in the respiratory rate, the effect of uncoupling agents such as ipomeamarone [loc. cit. and 34, p. 395] probably being only partly responsible. Furthermore, infected tissues produce a thermolabile, non-dialysable fraction containing an inhibitor. In white [ordinary] potato tissue, which displays marked resistance to black rot infection, this fraction inhibited spore germination. A similar effect in potato infected with *Phytophthora infestans* was described recently (6th April, 1955) at a meeting of the Phytopathogical Society of Japan, and given a similar explanation.

Combined Annual Report of the Central Rice Research Institute, Cuttack, 1949–50 and 1950–51. Annual Reports of the Central Rice Research Institute, Cuttack, 1951–52, 1952–53.—33 pp.; 33 pp.; 35 pp., 1954.

The section of the combined report for the years 1949–50 and 1950–51 dealing with mycology (pp. 23–29) refers to investigations at Cuttack, India, on *Helminthosporium oryzae* [*Ophiobolus miyabeanus*: *R.A.M.*, 34, pp. 104, 772]. Natural infection was observed on a common grass in rice fields, *Echinochloa colona*. In inoculation tests susceptible hosts included *Setaria glauca*, maize, *S. italica*, *E. frumentacea*, sorghum, *Panicum miliaceum*, *P. miliare*, and *Euchlaena mexicana*. In inoculation experiments, using ten rice varieties, at 28° to 30° C. only 4 per cent. infection developed on one of them, but at 20° to 26° eight varieties developed from 4 to 24 per cent. infection.

In one test field infected by blast (*Piricularia oryzae*) [34, p. 772] an increase in yield of 37 per cent. was achieved by weekly sprays of Bordeaux mixture (5–5–50) at 100 gals. per acre from mid September to mid October, though in other fields the gain was much less.

Rice grain spotting [cf. 29, p. 329], due mainly to *O. miyabeanus*, *Trichoconis padwickii*, *Curvularia lunata* [34, p. 175], and a species of *Cephalosporium*, was highest in early varieties flowering in the late monsoon, and in later varieties of over 160 days' duration. The only effect of fungicidal treatment of seed was an improvement in germination of both healthy and spotted seed of some varieties treated with agrosan GN.

The loss of viability of rice seed stored during the monsoon was thought to be due to penetration by common moulds, mostly *Penicillium* species [31, p. 505], and bacteria, forming the surface microflora of the seed. In seed stored at a relative humidity above 50 per cent. fungicidal treatment merely retarded loss of viability.

In the 1951–2 report a list is given (pp. 22–25) of 20 rice varieties resistant to *O. miyabeanus* in the field, both in the seedling and adult stages, eight of which were also resistant in the adult stage to artificial infection.

In further studies on *Piricularia oryzae* it was shown that the intensity of foliar and neck infection was highest on the youngest plants in September to October, and higher in manured than unmanured plots. Consequently susceptible varieties

such as Co. 13 should be planted early to avoid peak incidence of the disease. The percentage of neck infection was reduced to half that in the untreated plots (36 per cent.) by Bordeaux sprays (5–5–50) applied four times during the crop season, and the yield was increased by 55 per cent.

In the report covering 1952–3 it is stated (pp. 25–29) that six rice varieties were relatively resistant to *O. miyabeanus* in the seedling and adult stages, namely Ch. 13, Ch. 45, Co. 20, T. 141, T. 498–2A, and BAM. 10. Increased catches of conidia of *O. miyabeanus* on greased slides [34, p. 105] were associated with an increase in relative humidity a day or two previously, cloudy weather, and a lessening of the mean daily temperature range.

In studies on the effect of Bordeaux (5–5–50) sprays on the incidence of *P. oryzae* on the susceptible variety Co. 13 the percentage neck infection was 5·8 in plots receiving five sprays, 10 in those given two sprays before ear emergence, and 9·2 in those given two sprays after ear emergence, compared with 13·5 in unsprayed plots.

Akai (S.). **Chemotherapeutic application of some compounds to Rice plants and the outbreak of Helminthosporium leaf spot.**—*Shokubutsu-Byogai-Kenkyu*, 5, pp. 45–56, 1955. [Abs. in *Chem. Abstr.*, 49, 20, col. 14253 *i*, 1955.]

At Kyoto University, Japan, the immersion of rice seed for 24 hours at room temperature in a solution of 2 p.p.m. copper sulphate and 200 p.p.m. boric acid gave effective control of the leaf spot caused by *Helminthosporium* [*Ophiobolus miyabeanus*: *R.A.M.*, 34, pp. 542, 814; 35, p. 40; and next abstract]. The percentages of foliar infection following 48 hours' soaking of the seed at 36° C. in solutions of 2,4-D at 10^{-3}, 10^{-4}, 10^{-5}, and 10^{-6} per cent. and a control solution were 31, 41, 66, 62, and 100 per cent., respectively. The 10^{-3} per cent. treatment caused marked delay in the initial growth of the seedlings, but they subsequently recovered almost completely. When seedlings were treated twice with 1,4-dihydronaphthoic, 1,2,3,4-tetrahydroic, and '2,4,5-trihydronaphthoic' acids at a concentration of 2 p.p.m. to begin with and 5 p.p.m. after four days, the infection percentages were 21, 11, and 61 per cent., respectively. The first-named acid at 10^{-2} per cent. inhibited conidial germination by 50 per cent., the second was inactive at any concentration, while the third (which caused some injury to the plants) allowed only 7 per cent. germination at a strength of 2×10^{-2} per cent.

A significant measure of protection was conferred by soaking seed and seedling roots in 0·01 to 0·02 per cent. solutions of vitamin K_3 (2-methyl-1,4-naphthoquinone). Infection by *O. miyabeanus* was also substantially reduced by pentachlorophenol, its sodium salt, and pentachlorophenoxyacetic acid, which were, however, phytotoxic at a concentration of 0·0025 per cent., turning the foliage yellow.

Asada (Y.) & Akai (S.). **Effect of expressed cell sap of Rice-plant leaves upon the germination of Cochliobolus miyabeanus conidia.**—*Shokubutsu-Byogai-Kenkyu*, 5, pp. 63–66, 1955. [Abs. in *Chem. Abstr.*, 49, 20, col. 14116 *i*, 1955.]

In an experiment at the Matsuyama Agricultural College, Ehimeken, Japan, the expressed cell sap of three rice varieties resistant to *Cochliobolus* [*Ophiobolus*] *miyabeanus* [*R.A.M.*, 34, p. 104 and preceding abstract] markedly inhibited conidial germination, which was promoted, on the other hand, by that of three susceptible ones as compared with distilled water. The inhibitory activity of the cell sap was destroyed by heating and autoclaving. The substance extracted with ether from the sap was divided into two fractions, one soluble in acid and the other in alkali; the latter suppressed conidial germination slightly.

Goto (K.) & Fukatsu [Fukazu] (R.). **Studies on the stem rot of Rice plant. I. Varietal resistance and seasonal development.**—*Bull. Div. Plant Breed. Cult.*

Tokai-Kinki. agric. Exp. Sta. 1, pp. 27–39, 6 graphs, 1954. [Japanese, with English summary.]

At the Tokai-Kinki Agricultural Experiment Station, Ogoso, Japan, 120 rice varieties were tested for resistance to stem rot [*Leptosphaeria salvinii*: *R.A.M.*, 33, p. 560; 35, p. 40]. Varieties of the tillering Shinriki and Sembon types were resistant, as also was the non-tillering Gimbozu from Gifu. Early varieties were more susceptible than late, possibly due to the early appearance of the disease and a temporary lull in the hot summer weather. After heading *L. salvinii* progressed rapidly in severity.

Katsura (K.), Tokura (R.), & Furuya (T.). **Studies on the downy mildew of Rice plant. II. Wild grasses as the source of primary infection to Rice plant in nursery bed.**—*Sci. Rep. Fac. Agric. Saikyo Univ.* 6, pp. 49–66, 2 pl., 1 fig., 1954. [Japanese, with English summary.]

During the early part of the rice growing season (late April to early May) investigations in nurseries in Kyoto, Shiga, and Fukin, Japan, showed that the wild grasses, particularly *Beckmannia syzigachne*, *Alopecurus aequalis*, *Agropyron tsukusiense*, *Phalaris arundinacea*, and *Poa annua* were attacked by rice downy mildew (*Sclerospora macrospora*) [*R.A.M.*, 34, p. 396; 35, p. 40] The symptoms are described. Zoosporangia formed on leaves of *A. tsukusiense* in water were able to infect rice seedlings, giving 23·7 per cent. infection at 19·5° C. (optimum) and 7 per cent. at 26°. Germination of these zoosporangia was 86·6 per cent. at the optimum of 18° to 19·5°, with 61 per cent. at the minimum of 12° to 13°, and 0·6 per cent. at the maximum of 29°. Moderate infection of rice seedlings was achieved within five hours using zoosporangia formed on *Alopecurus aequalis* and *B. sizygachne* but not with those on *P. arundinacea*. Climatic conditions in the infected fields were suitable for transference of infection to the young rice plants from the wild grasses, which were probably infected by *S. macrospora* during the preceding autumn. It is concluded that biennial and perennial wild grasses are important sources of primary infection of nursery rice plants by *S. macrospora*.

Govinda Rao (P.) & Venkata Reddy (T. C.). **Occurrence of Ustilaginoidea virens (Cke.) Tak. on Oryza officinalis Wall.**—*Indian Phytopath.*, 8, 1, pp. 72–73, 1955.

During January, 1954, wild rice (*Oryza officinalis*) growing at the Agricultural Research Station, Maruter, in the West Godavari district of India was infected by false smut (*Ustilaginoidea virens*) [*R.A.M.*, 33, p. 338], the sclerotia being slightly smaller than those produced on cultivated rice.

Paardekooper (E. C.). **Eerste resultaten van de meeldauw-resistentie-selectie bij Hevea.** [First results of the selection of *Hevea* for mildew resistance.]—*Bergcultures*, 24, 13, pp. 319–323, 1955. [English and Indonesian summaries.]

A tabulated survey is given of the results of preliminary investigations at the Bogor Experiment Station, Java, to determine the feasibility of combining the high degree of resistance to mildew (*Oidium* [*heveae*]) in the rubber clone LCB 870 [*R.A.M.*, 32, p. 147; 34, p. 543] with productivity. In two pot trials the incidence of infection on a number of clones and LCB 870 seedlings of unknown parentage was observed to vary considerably, and further tests on the yield capacity of the more promising were planned.

In 1952 and 1953 a definite correlation was established between the inception, rate, and uniformity of wintering on the one hand and mildew infection on the other. The beginning of August was the critical period, those trees which were not entirely refoliated by that time being almost invariably attacked.

Young's findings as to the association of rapid cuticle formation with resistance to mildew in LCB 870 [30, p. 542] could not be confirmed.

GARRETT (S. D.). **A century of root-disease investigation.**—*Ann. appl. Biol.*, 42 (*Proc. Jubilee Meeting, London, 13–17 Sept., 1954*), pp. 211–219, 1955.

A brief historical survey is presented of root-disease investigation during the past hundred years [cf. *R.A.M.*, 29, p. 420; 31, p. 514 and next abstract]. Three main phases are distinguished, etiology, environment, and microbial ecology. In the first two the investigations followed the general pattern of development in mycological plant pathology, but in the third and contemporary phase they are recognized as belonging also to soil microbiology [35, p. 122]. Until well into the twentieth century pathologists were mainly occupied in determining the parasites causing various root diseases, but during the second decade workers began to consider the effect of cultural environment on the growing crop and the possibilities of controlling this [6, p. 365].

The modern era of root-disease investigation began when the general microbial population of the soil was realised to be a vital factor [cf. 6, pp. 45, 684]; the recognition of the importance of experimenting with mixed cultures of micro-organisms [10, p. 681], early work on *Trichoderma viride* in relation to *Rhizoctonia* [*Corticium*] *solani* [12, p. 192], and investigation of the interaction between temperature and antibiotic effects in take-all of cereals (*Ophiobolus graminis*) [12, p. 18] were landmarks in the progress of root pathology studies.

It is now realized that the normal microflora of the soil exerts a natural biological control of most soil-borne diseases, and the problem is to discover ways of increasing this. In sterilized or partially sterilized soils it is essential to hasten natural re-colonization by the normal microflora, and if conditions favour a microflora more effective in biological control, so much the better. The new fungus flora of such soils is frequently dominated by *T. viride*, some strains of which produce significant quantities of either gliotoxin or viridin [30, p. 531]. Opposite effects can result from the action of different organic manures on one disease or from the same manure acting upon different components of the host-parasite equilibrium [29, p. 253].

Attempts at biological control will be successful only if integrated with the most exhaustive studies of root-disease epidemiology. The knowledge obtained in laboratory and field is complementary, resulting in improved control by various permutations of crop rotation, cultivation, manuring, and soil amendment, as well as by the production of resistant varieties of crop plants. The advocacy of special and costly control measures, however ingenious and spectacular, must be regarded as a confession of failure.

RISHBETH (J.). **Root diseases in plantations, with special reference to tropical crops.** —*Ann. appl. Biol.*, 42 (*Proc. Jubilee Meeting, London, 13–17 Sept., 1954*), pp. 220–227, 1955.

After reviewing briefly past work on eradication of root diseases of rubber (*Fomes lignosus*, *F. noxius*, and *Ganoderma pseudoferreum*) [*R.A.M.*, 12, p. 54; 17, p. 62; 33, p. 560, *et passim*] and of tea and tung (*Armillaria mellea*) [19, p. 311; 32, p. 703], the author draws attention to some interesting parallels in the behaviour of *F. annosus* in conifer plantations in the northern hemisphere [31, p. 640; 35, p. 133]. It is stressed that there is urgent need for further information about stump infection, particularly by air-borne spores. In East Anglia pines display a marked increase in resistance to *F. annosus* when about 25 years old, mainly as a result of increased resin production by the roots, and are more resistant on acid than on alkaline soils. Resistance appears to be low where the soil is abnormally dry. Both with *F. annosus* on young pines and *F. lignosus* on young rubber, the incidence of root disease is conspicuously greater when former forest sites are burned after clearing.

Regarding vascular wilts of tropical crops such as cotton and banana, the author

has recently confirmed that *Fusarium oxysporum* f. *cubense*, causing Panama disease of bananas [34, p. 655], is distinguishable from the common soil saprophyte *F. oxysporum* only by a suitable host test. Pending the development of further resistant varieties and other methods of control [34, p. 43], the most important precaution is the improvement of soil structure and fertility, as further deterioration may lead to the infection of varieties at present regarded as resistant.

Atkinson (R. G.) & Robinson (J. B.). **The application of a nutritional grouping method to soil fungi.**—*Canad. J. Bot.*, 33, 3, pp. 281–288, 1 fig., 1955.

Most of the 1,914 [unspecified] soil fungi isolated from potato plots and tested at the Plant Pathology Laboratory, St. Catharines, Ontario, fell into one of three nutritional groups, requiring, respectively, for optimum growth the addition of amino acids, amino acids plus growth factors, or yeast extract to a liquid medium containing potassium nitrate and 0·1 per cent. glucose. Growth was generally poor on the basal medium alone or plus soil extract. In plots receiving soy-bean green manure fungi requiring yeast extract were isolated less frequently from soil adhering to potato tubers than from soil at a distance from the tubers. In an untreated plot no such differences were observed. The results indicate that the grouping of isolates according to their growth requirements may be of value in determining the activity of fungi in the soil.

Kolcheva (Mme B.A.). Микробиологическая характеристика почв Болгарии. [Microbiological characteristics of Bulgarian soils.]—Природа [*Nature = Priroda, Moscow*], 44, 9, pp. 69–72, 1 fig., 3 graphs, 1955.

A recent survey of Bulgarian soils, based on the results obtained by a Soviet–Bulgarian soil expedition in 1947, revealed that the basic microflora consists of actinomycetes, which are more prevalent at higher altitudes than in the plains. Species of *Penicillium* were predominant at higher levels and those of *Aspergillus*, *Fusarium*, and *Alternaria* in the plains. These fungi were found mostly in the upper soil layers.

Agnihothrudu (V.), Bhuvaneswari (Miss K.), & Suryanarayanan (S.). **Fungi isolated from rhizosphere. I.**—*Proc. Indian Acad. Sci.*, Sect. B, 42, 3, pp. 98–104, 5 figs., 1955.

Descriptions are given of five fungi isolated at the University Laboratory, Madras, from the rhizospheres of crop plants [cf. *R.A.M.*, 34, p. 673; 35, p. 124], especially pigeon pea. *Melanospora brevirostrata*, *Aspergillus giganteus*, and *Oedocephalum coprophilum* are new records for India. *Stachybotrys atra* and *Dendryphion interseminatum* were also isolated.

Bilai (V. I.). О паразитарных и фитосимбиотрофных свойствах видов рода **Fusarium Lk.** [Concerning the parasitic and phytosymbiotrophic properties of species of the genus *Fusarium* Lk.]—Микробиология [*Microbiology, Moscow*], 23, 2, pp. 178–183, 1954.

Two years' investigations at the Zabolotnuy Institute of Microbiology, U.S.S.R. Academy of Sciences, Kiev, showed that various species of *Fusarium* affect the germination, growth, and yield of cereals differently. Considerable yield increases occurred after soil or seed infection with *F. culmorum*, *F. avenaceum*, *F.a.* var. *herbarum*, and some cultures of *F. sporotrichiella*. Pathogenic properties were distinctly lacking in species of the sections Elegans and Liseola, isolated from cotton roots and the soil adjacent to them. Data obtained in these investigations suggest the introduction of certain changes in the systematics of the genus *Fusarium*, according to which host specificity should be regarded as a characteristic of definite forma speciales rather than different species.

McNaught (K. J.). **Trace element deficiencies in market garden crops.**—*N.Z. J. Agric.*, 90, 6, pp. 563, 565, 567–568, 6 figs., 1955.

In New Zealand trace element deficiencies are stated to be less severe in market-garden crops than in pasture and farm crops. In 1948 cracked stem of celery [cf. *R.A.M.*, 34, p. 340], characteristic of boron deficiency, was prevented by soil applications of 30 to 40 lb. of borax per acre six days before planting. In the Auckland district, especially on the volcanic soils, 20 to 30 lb. gave satisfactory results. Molybdenum deficiency, causing whiptail of cauliflowers [cf. 34, p. 283], was successfully corrected by adding 5 lb. ammonium molybdate per acre at Papatoetoe in 1945 and by seed-bed treatments with 1 oz. ammonium molybdate per 10 sq. yds at Hope, Waimea Plains, in 1950, and with sodium molybdate at the same rate three weeks before transplanting in the Oamaru district in 1950 and 1951. At the Department of Agriculture, Levin Horticultural Research Station, in 1952 a significant increase was obtained in the total weight of peas when 1 lb. sodium molybdate per acre was applied in the fertilizer. On peat soils responses to copper sulphate were observed in onions, carrots, and maize, and to a lesser extent in cauliflowers and lettuce. At Pukekohe 30 lb. copper sulphate per acre is recommended for onion crops not following potatoes.

Manganese deficiency in various vegetable and tomato crops is associated with over-liming or a high pH. Toxicity also occurs in these crops, very high levels having been found in tomato leaves showing interveinal necrosis and chlorosis reminiscent of magnesium deficiency symptoms. Manganese toxicity was remedied in many cases by liming the soil to a pH of about 6.

Giovannini (E.). **Il molibdeno 'elemento oligodinamico'.** [Molybdenum, an 'oligodynamic element'.]—*Ann. Sper. agr.*, N.S., 8, 3, *Suppl.* pp. xix–xxxvi, 2 graphs, 1954. [English summary.]

The author reviews the present state of knowledge concerning molybdenum in relation to plant life, with a bibliography of 59 references, and discusses its presence in plants and in the soil, its toxicity to plants and animals, and its determination by colorimetric and spectrographic methods.

Newman (R. J.). **Molybdenum deficiency in Central Highlands and Upper Goulburn regions, and adjoining districts.**—*J. Dep. Agric. Vict.*, 53, 10, pp. 451–463, 17 figs. (13 col.), 1 map, 1955.

The acidity (pH 5 to 6·1) of the soils in the Central Highlands and Upper Goulburn regions of Victoria, which are covered chiefly by wallaby grasses (*Danthonia* spp.), kangaroo grass (*Themeda triandra*), love grasses (*Eragrostis* spp.), and tussock grass (*Poa caespitosa*), and the lack of molybdenum [*R.A.M.*, 34, p. 95] hinder the establishment of vigorous swards of subterranean clover [*Trifolium subterraneum*] even when liberal amounts of superphosphate are applied.

At Buangor in the Central Highlands an experimental area was surface-worked and sown in May, 1952, with Bacchus Marsh subterranean clover (10 lb. per acre), inoculated with *Rhizobium*, and *Phalaris tuberosa* (2 lb.) and given various amendments. Clover growth was vigorous and healthy in the plots receiving molybdenum, whereas with superphosphate alone it was poor and showed deficiency symptoms. Unamended plots yielded 8·8 cwt. dry matter per acre, those receiving 4 cwt. superphosphate alone 8·6, and the same plus 2 oz. ammonium molybdate 43·6. In May, 1951, in a similar experiment at Emhurst, but with 5 lb. Bacchus Marsh clover, growth was poor in that year but in 1952, after additional superphosphate dressings, there were marked differences in growth. 4 oz. molybdenum trioxide per acre with the superphosphate giving in November, 1952, a dry matter yield of 59·5 cwt. per acre as against 9·8 cwt. from the unamended plots. During the same period an area at Stawell was fertilized and sown with Bacchus Marsh (5 lb. per

acre) and Yarloop clover (2 lb.) and *P. tuberosa* (2 lb.). A combination of 10 cwt. lime and 2 oz. molybdenum gave a small dry matter increase (total crop 46 cwt.) over 2 oz. molybdenum alone (42·3); the unamended plots yielded 14·7 cwt. Further field trials within the Central Highlands region and adjoining districts revealed molybdenum deficiency on 31 other sites.

In the autumn of 1950 experimental areas in the western part of the Upper Goulburn region were sown with a mixture of Mt. Barker and Tallarook subterranean clover at 5 lb. per acre, not inoculated with *Rhizobium* but initially treated with molybdenum, lime, and superphosphate. By the autumn of 1953 growth was poor on all the plots, but the addition to certain plots of another 2 cwt. superphosphate per acre stimulated pasture growth and induced marked responses to the initial molybdenum, alone or with lime. When a molybdenum solution was sprayed on part of the limed areas clover growth recovered immediately, indicating that the amount of molybdenum made available to plants by a dressing of 10 cwt. lime on these soils is small and not sufficient for maximum growth. The results of trials up to the end of 1954 revealed molybdenum deficiency at 13 other centres in this region. Experiments at Wandong in the autumn of 1953 demonstrated that subterranean clover could be established successfully by drilling the seed shallowly with small quantities of lime and superphosphate combined, but the addition of 2 oz. molybdenum was necessary for vigorous growth.

The main soils deficient in molybdenum in these regions are acid soils derived from Ordovician or Silurian sediments, but the deficiency also occurs in those derived from recent materials, granite, or basalt. The condition may be corrected by a single 2 oz. molybdenum dressing and by top-dressing in subsequent years with superphosphate only at 1 cwt. to 2 cwt. per acre per annum.

Bentley (C. F.), Hoff (D. J.), & Scott (D. B.). **Fertilizer studies with radioactive sulphur. II.**—*Canad. J. agric. Sci.*, 35, 3, pp. 264–281, 1 map, 1955.

From 1950 to 1952 fertilization experiments were carried out with sodium sulphate containing radio-active sulphur and other sulphur fertilizers on cereal and legume (lucerne and alsike clover) crops in 22 localities in Alberta, Canada. Sulphur deficiency in the grey soil zone was found to be erratic but important, the previous plot history and current fertilization both greatly affecting the sulphur content of the crops. An average application of 10 lb. sulphur per acre per annum is recommended for grey, sulphur-deficient soils under grain and legume rotation.

Haertl (E. J.). **New horizons in the application of chelation to agriculture.**—*Down to Earth*, 2, 1, pp. 6–9, 4 figs., 1955.

The author explains the nature and action of chelating compounds [*R.A.M.*, 35, p. 41 and next abstract], which bind metallic ions into a form assimilable by plants; he deals in greater detail with the synthetic chelating agents ethylenediamine tetra-acetic acid or EDTA present in the commercial compound versene and ethanol ethylenediaminetriacetic acid (EEDTA) in versene-01, discussing their economic advantages, yield increase secured, foliar applications, effect on crop quality, results with non-ferrous metal chelates, and application to soils and in nutritional research.

In the absence of acute deficiencies chelated iron [35, p. 98] is reported to increase the yield of citrus, maize, tomato, escarole, and potato, and the fresh weight of sunflower plants; chelates improved the quality of citrus and potatoes. Zinc, copper, manganese, boron, and molybdenum chelates proved beneficial in counteracting corresponding deficiencies in the soil.

There is likely to be an increased need for chelated metals to maintain maximum growth and yield of crops, which should lead to the inclusion of chelating agents and chelated metals in fertilizers.

Lunt (O. R.) & Wallace (A.). **Use of iron chelates.**—*Calif. Agric.*, 9, 6, p. 4, 1955.

The new iron chelating compound Fe 138 [cf. preceding abstract], an aromatic amine, showed promise in experiments designed to correct iron chlorosis in plants by supplying the element in an assimilable form. There was little iron precipitation from this chelate in calcareous soil, and it seemed to be less toxic than EDTA [loc. cit.].

Conference of Cane Pest and Disease Control Boards.—*Cane Gr. quart. Bull.*, 18, 1, pp. 13–14, 1954.

At the 16th annual conference of Cane Pest and Disease Control Boards, held at Mackay, Queensland, on 29th April, 1954, C. G. Hughes reported that a drop in temperature of 1° C. from the normal 50° during heat treatment for two hours was responsible for 10 per cent. of the sugar-cane setts remaining infected with ratoon stunting virus [cf. *R.A.M.*, 33, p. 320]. When the time of treatment was reduced to 1½ hours, 80 per cent. of the setts remained infected, indicating the importance of maintaining a minimum temperature of 50°, or even a slightly higher one for any cane able to tolerate it, for the full treatment period of two hours.

E. Blundell and C. K. Simpson described a new type of cutter planter containing a dipping bath for organic mercurial solution to control pineapple disease [*Ceratocystis paradoxa*: 34, p. 630]. C. G. Hughes and G. Wilson stated that P.M.A. (phenyl mercuric acetate) was as effective as aretan and similar organic mercurials in controlling this disease.

Orian (G.). **La maladie de Fidji de la Canne à Sucre.** [The Fiji disease of Sugar-Cane.]—*Rev. agric. sucr. Maurice* (formerly *Rev. agric. Maurice*), 34, 1, pp. 28–34, 2 pl., 1955.

This information on Fiji virus disease of sugar-cane, its occurrence in Madagascar, and the possible danger of its introduction into Mauritius, has already been noticed [*R.A.M.*, 35, p. 43].

Dos Santos (Aniceta C.) & Da Camara (E. de S.). **Fungi Lusitaniae IX.** [Fungi of Portugal IX.]—*Agron. lusit.*, 16, 3, pp. 175–194, 2 pl., 1954. [Received December, 1955.]

The present instalment of the current annotated list of Portuguese fungi [cf. *R.A.M.*, 34, p. 613] comprises 63 species, of which 10 are new to science and 18 are recorded for the first time from Portugal. *Bougainvillea* twigs are infected by *Phomopsis bougainvilleae*, *Dothiorella bougainvilleae* n. sp., and *Coniothyrium bougainvilleae* n. sp., the two latter being associated. *D. bougainvilleae* produces subglobose or subovoid, black pycnidia, 314 to 415 by 270 to 340 μ; cylindrical, branched, fasciculate, hyaline conidiophores, 11·7 to 13 μ in length; and somewhat cylindrical or ovoid, straight, biguttulate, continuous, hyaline conidia, 1·9 to 5 by 0·75 to 1·9 μ. The spherical, papillate, black pycnidia of *C. bougainvilleae* measure 200 to 249 by 133 to 216 μ and the mostly globose, rarely oblong, continuous, pale ferrugineous conidia 3·8 to 4·5 by 3·8 to 4·6 μ.

D. rhododendri n. sp., observed on *Rhododendron* twigs in the company of *Botryosphaeria rhododendri* n. sp., *Didymosphaeria rhododendri*, and *Pestalozzia* [*Pestalotia*] *funerea* [27, p. 455], is characterized by globose, sometimes subpapillate, black pycnidia, 163 to 241 by 155 to 190 μ; cylindrical, erect, fasciculate, hyaline conidiophores, 15·2 to 22·8 by 3·4 to 3·8 μ; and ellipsoid, straight, continuous, greyish-blue to hyaline conidia, 11·4 to 19 by 4·8 to 7·6 μ. The globose, subpapillate, intensely black perithecia of *B. rhododendri* measure 117 to 228 by 152 to 209 μ; the paraphysate, roughly ellipsoid, sessile, hyaline asci 79·8 to 95 by

19 to 22·8 μ; and the distichous, mostly ellipsoid, sometimes lemon-shaped, straight, hyaline conidia 18·6 to 22·8 by 7·6 to 11·4 μ.

Gloeosporium smilacis n. sp. forms on *Smilax aspera* var. *nigra* branches conoid, brown acervuli, 114 by 68·4 to 79·8 μ; straight or rarely curved, fasciculate, hyaline conidiophores, 10·2 to 11·9 by 1·4 to 1·7 μ; and ellipsoid or cylindrical, straight or very slightly curved, continuous, greyish-blue to hyaline conidia, 26 to 28·6 by 7·8 to 10·4 μ. It is accompanied by *Metasphaeria nervisecula*, *Leptosphaeria smilacis*, and *P. funerea*.

The other records include *Coleosporium solidaginis* on pine (*Pinus pinaster*) needles [cf. 30, p. 351]; *B. berengeriana* [33, p. 182] on avocado leaves and on twigs of *Cassines maurocenia* and cork oak (*Quercus suber*), sometimes in conjunction with *Macrophyllosticta allospora* n. sp.; *Didymosphaeria dimastospora* on olive branches; *Cytospora* [*Valsa*] *leucostoma* on pear branches; *Macrophoma camelliae* on tea twigs; *Phyllosticta cherimoliae* on *Annona muricata* leaves; *Colletotrichum gloeosporioides* on petioles of *Dahlia maxonii*; and *Oidium quercinum* on oak leaves.

Brien (R. M.) & Dingley (Joan M.). **Second supplement to 'A revised list of plant diseases recorded in New Zealand,' 1952–1955.**—*N.Z. J. Sci. Tech.*, Sect. A, 37, 1, pp. 27–35, 1955.

Listed in this second supplement of diseases occurring in New Zealand [cf. *R.A.M.*, 33, p. 53] are 111 fungal, bacterial, virus, and physiological diseases on 162 hosts, including many additional host records. New disease records are *Alternaria brassicicola* on cabbage, *Exobasidium camellia* on *Camellia japonica*, *Herpobasidium deformans* on *Lonicera japonica*, *Mycosphaerella alba* on white mulberry, *Spilocaea oleaginea* [*Cycloconium oleaginum*] on olive, *Cercospora omphacodes* and *Septoria phlogis* on *Phlox paniculatum*, *Sphaceloma rosarum* on rose, *C. depazeoides* on elder, *A. senecionis* on cineraria, *C. zebrina* and *Sphaerulina trifolii* on clover, *C. violae* on *Viola tricolor* var. *hortensis*, and *Helminthosporium turcicum* on maize. *Verticillium dahliae* is reported on 19 and *Pseudomonas syringae* on 18 additional hosts. Among the virus diseases of economic importance are cereal yellow dwarf on wheat and *Bromus* spp., lettuce big vein, cauliflower mosaic on several *Brassica* spp., citrus quick decline [tristeza: 35, p. 82], freesia mosaic, and lily mosaic [a strain of cucumber mosaic virus].

Malençon (G.). **Prodrome d'une flore mycologique du Moyen-Atlas. 2e Contribution.** [Prodrome of a mycological flora of the Middle Atlas. Second contribution.]—*Bull. Soc. mycol. Fr.*, 70, 2, pp. 117–156, 8 figs., 1954. [Received 1955.]

This second contribution to the fungi of the Middle Atlas region of Morocco [cf. *R.A.M.*, 32, p. 511] includes those collected since 1952 in the central part, the Tazzeka Massif, and the Bab Ahzar forest. The majority are new to the country.

Nicolas (G.) & Aggéry [Berthe]. **Deuxième contribution à l'étude de la flore mycologique des Pyrénées-Orientales.** [Second contribution to the study of the mycological flora of the eastern Pyrenees.]—*Bull. Soc. mycol. Fr.*, 70, 1, pp. 65–92, 1954. [Received 1955.]

Most of the entries in this second contribution to the fungi of the eastern Pyrenees [*R.A.M.*, 30, p. 585] have been noticed from other sources [33, p. 504 *et passim*].

Hamant (C.). **Micromycètes récoltés en Lorraine.** [Microfungi collected in Lorraine.]—*Bull. Soc. mycol. Fr.*, 71, 1, pp. 37–53, 1955.

The author presents an annotated list of microfungi collected in the Château-Salins district of Lorraine [cf. preceding abstract], chiefly during the past few years.

Vernon (T. R.). **Spore formation in the genus Streptomyces.**—*Nature, Lond.*, 176, 4489, pp. 935–936, 1 fig., 1955.

Electron-microscope studies of streptomycetes from New Zealand soils made at the Plant Diseases Division, Department of Scientific and Industrial Research, Auckland, New Zealand, revealed that spore formation takes place within the hyphal wall. The contents divide into fragments which are separated by less dense partitions resembling septa. The fragments are rather irregular in size and divisions appear to occur simultaneously along the hypha. The spores remain in chains, held together by the sheath-like hyphal wall. In some strains this wall persists, the spores being liberated by means of a longitudinal split and the old wall appearing as a ribbon-like sheath. In others it disintegrates readily, only small fragments remaining to show where it was. Several isolates produced spores with spiny processes which developed within the hyphal wall in the normal manner and were liberated as described above.

Hesseltine (C. W.). **Genera of Mucorales with notes on their synonymy.**—*Mycologia*, 47, 3, pp. 344–363, 1955.

Keys are given to assist in the determination of the families and genera of the Mucorales, with an outline of previous arrangements of the genera in the nine families recognized. The generic synonymy, type species, and approximate number of species in each genus are noted.

Grasso (V.). **Rassegna delle specie di Claviceps e delle loro piante ospiti. Parte I.** [A check list of the species of *Claviceps* and of their host plants. Part I.]—*Ann. Sper. agr.*, N.S., 9, 1, *Suppl.*, pp. li–lxxxix, 1955. [English summary.]

The diagnosis and synonymy of the genus *Claviceps* [cf. *R.A.M.*, 32, p. 565] are given, followed by a list of all known species, with the original diagnoses and the hosts (over 100) of the conidial state. The hosts (about 460) on which the sclerotial state has been recorded are listed, with the species found on each, the locality concerned, and bibliographical reference numbers [the bibliography is not yet given]. About 400 hosts have been reported for *C. purpurea*, 20 for *C. microcephala*, 20 for *C. paspali*, and 16 for *C. pusilla*.

Gallucci-Rangone (Maria M.). **Su tre specie di Pestalotia nuove per l'Italia.** [On three species of *Pestalotia* new for Italy.]—*Ann. Sper. agr.*, N.S., 8, 5, pp. 1437–1457, 2 pl., 3 figs., 1954. [English summary.]

Full descriptions are given of the morphological and cultural characters of *Pestalotia gracilis* [*R.A.M.*, 14, p. 608], found on *Laurus nobilis*, *P. gallica* (Steyaert) n. comb. on *Camellia japonica*, and *P. disseminata* [cf. 16, p. 191; 22, p. 412; 29, p. 112] on *Cattleya* sp. in 1952 in Italy, the first on a new host, the others constituting new fungal records for the country. The author considers the genus *Pestalotiopsis* [34, p. 260] superfluous and accordingly makes the new combination *Pestalotia gallica* cited above. From the different behaviour of the three species on numerous media it is inferred that their cultural characters can constitute reliable criteria for their differentiation.

Zambettakis (C.). **Recherches sur la systématique des Sphaeropsidales—Phaeodidymae.** [Studies on the systematics of the Sphaeropsidales—Phaeodidymae.]—*Bull. Soc. mycol. Fr.*, 70, 3, pp. 219–350, 1954.

The author proposes alternative morphological characters for classifying the Phaeodidymae in the Sphaeropsidales [cf. *R.A.M.*, 34, p. 820], resulting in the erection of four new genera and three new species. After presenting a key for identifying the 23 genera of this group he gives notes on the species in each, on some atypical or aberrant species, and on other genera now excluded.

Annual Administration Report for 1954–1955 of the Scientific Department (Tea Section) of the United Planters' Association of Southern India.—21 pp., [1955].

The report of the Botanist (K. S. Venkataramani, pp. 15–21) [cf. *R.A.M.*, 34, p. 488] includes the following items. A species of *Cylindrocarpon* tentatively identified as *C. radicicola* was isolated for the first time in southern India from the dead roots of a few tea plants received from a Coorg nursery. Its pathogenicity has yet to be determined. Of various soil amendments tested for their effect on the survival of *Cylindrocladium* [34, p. 489; 35, p. 127] in infested soil in the laboratory, only cattle manure at 40 tons per acre mixed evenly with the soil prevented colonization of buried tea roots. Branches of *Crotalaria grahamiana* bore cankers and numerous perithecia of *Nectria haematococca* [cf. 31, p. 302], the perfect state of *Fusarium solani*; its pathogenicity was established. *Phytophthora* sp. caused flower blight of *C. anagyroides* in green manure plots at the Experiment Station at the end of the south-west monsoon.

Proceedings of the Third Annual Conference of the Scientific Department of the United Planters' Association of Southern India, 1955.—*Rep. Tea sci. Dep. un. Pl. Ass. S. India, 1954–55*, pp. 22–45, 3 graphs, [1955].

V. Jayaraman, in a paper on the physical and chemical aspects of the laboratory evaluation of copper fungicides (pp. 31–33), states that at present there are three types of copper formulation available for the control of tea blister blight [*Exobasidium vexans*] in southern India [*R.A.M.*, 34, p. 550], viz., oxides, oxychlorides, and colloidal coppers, besides the standard Bordeaux and Burgundy mixtures. Samples of each were tested for their ability to remain in suspension, and the amount of copper in the spray liquid from a knapsack sprayer used in a normal spraying operation was determined. All the suspensions remained uniform with no settling in the spray tank or clogging of the nozzles. With one sample of cuprous oxide that had been in store, only 49·3 per cent. of the copper remained in suspension after four minutes compared with 99·2 cent. for a fresh sample, but there were no comparable reductions in the suspension value of old samples of copper oxychloride and colloidal copper. In further experiments one sample of each formulation was allowed to dry on the surface of 12 detached tea leaves for three hours after which the deposit on six leaves was determined individually, the other six being washed for five minutes before the determinations were made. For cuprous oxide 67 per cent. of the original copper remained after washing, compared with 88 per cent. of the colloidal copper and 96 per cent. of the copper oxychloride.

K. S. Venkataramani (pp. 34–37) discusses the theoretical considerations of the biological assay of copper fungicides in the laboratory and the methods now adopted. Twenty formulations are being tested for fungitoxicity by a method based on the slide germination technique [21, p. 211] and for tenacity by one similar to that of Heuberger [20, p. 70], using *E. vexans* as the test organism. The results of these tests will enable the formulations to be grouped into four classes, viz., highly toxic and highly resistant to rainfall, weak in both respects, and weakly toxic and highly resistant to rainfall and vice versa.

Webster (B. N.). **Report of the Mycologist for the year 1954.**—*Bull. Tea Res. Inst. Ceylon* 36, pp. 50–53, 1955.

This report [cf. *R.A.M.*, 34, p. 402] includes the following items. Tea blister blight [*Exobasidium vexans*] was rather more severe than in recent years, particularly in the low-country, owing to long, dull periods during the south-west monsoon. The yield figures for the St. Coombs No. 8 field experiment [loc. cit.] were 855 lb. made tea per acre for block A (unsprayed), 1,387 lb. for block B (sprayed during both monsoons), and 1,245 lb. for block C (sprayed during the south-west monsoon only). Following the widespread use of the Boomjet OC-O2

nozzle the spray area covered has increased to 3½ to 4 acres per man per day; up to 6 acres are claimed on easy terrain.

A spray trial with four 50 per cent. copper fungicides on the Clarendon Estate, Nanu Oya, resulted in good protection with the new Sandoz product 'Copper Sandoz 53' and cuprokylt.

Investigations into the defoliation of tea hitherto ascribed to *Rhizoctonia* [*Corticium*] *solani* [loc. cit.] are now being made to determine the role of shot-hole borer [*Xyleborus fornicatus*] infestations.

Root lesions of a type not previously recorded on tea and apparently limited to bushes already infected by the phloem necrosis virus spread rapidly, large patches of bushes being killed. A stunting of new growth following pruning which affected four estates was sporadic and apparently non-infectious and is probably identical with that reported from East Africa (Annual Report of the Tea Research Institute of East Africa for 1952).

Laoh (J. P.). **Fungicidenproeven bij blisterblight (Exobasidium vexans) op Thee.** [Experiments with fungicides against blister blight (*Exobasidium vexans*) on Tea.]—*Arch. Theecult. Ned.-Ind.*, 19, 1, pp. 1–9, 2 graphs, 1955. [English and Indonesian summaries.]

In an experiment on the control of blister blight (*Exobasidium vexans*) of tea on the Sperata Sinumbra estate, West Java [*R.A.M.*, 33, p. 323 and following abstracts], phenyl mercury acetate (0·05 per cent.) and combacide (3,5 dimethyl tetrahydro-1,3,5,2-thiadiazine 2-thione) at a concentration of 0·025 per cent. were compared with the standard copper oxychloride at 0·25 per cent., with the addition of 0·65 per cent. teepol to each. All were applied at seven-day intervals with Senior knapsack sprayers at 200 l. per ha. Neither combacide nor phenyl mercury acetate exerted any preventive effect on the development of the disease, although both were shown to possess fungicidal properties. Copper oxychloride gave effective control, reducing the average number of stem infections per plot from 141 (untreated) to seven and the average number of sporulating blisters per 50 third leaves from 20·5 to 3·3, and increasing the average number of shoots per plot from 248 to 765 and the total yield per plot from 36·1 to 62·9 hkg.

In a second test the dusts bulbosit (based on nirit [cf. 31, p. 67]), 10 per cent. *Acacia decurrens* bark mixed with a locally made carrier, and 2 per cent. copper oxychloride with a similar admixture were applied at seven-day intervals with Feeny and Birchmeyer hand dusters at the rate of 10 kg. per ha. Bulbosit gave adequate control of *E. vexans* while *A. decurrens* bark conferred a measure of protection. The former, however, is rather expensive and the latter is apt to impart a disagreeable flavour to the finished product, while neither was as effective as copper oxychloride [cf. 34, p. 551].

Laoh (J. P.). **Enkele resultaten van het blisterblight onderzoek in West-Java.** [Some results of the blister blight investigation in West Java.]—*Arch. Theecult. Ned.-Ind.*, 19, 1, pp. 12–35, 2 diags., 6 graphs, 1955. [English and Indonesian summaries.]

Further information is presented in connexion with the current series of investigations on the control of blister blight (*Exobasidium vexans*) of tea in West Java [see preceding and next abstracts]. Good results were obtained with both technical copper oxychloride and Shell copper fungicide (2 per cent. copper), the former mixed with volcanic tuff and the latter with kaolin, applied at five-day intervals with a Whirlwind motor duster at 10 kg. per ha. During periods of heavy disease incidence (which alone permit of an estimate of the fungicidal effects), yields in the treated plots were about 20 per cent. higher than in the untreated up to a distance of 85 m. from the pathway of application. At the same time the copper

residue was 50 gm. per ha. at a distance of 70 m. from the same point. A logarithmic relationship was established between the number of stem infections per unit weight of wet leaf and the amount of copper applied.

Van der Knaap (W. P.). **Appendix: statistische verwerking van de proefresultaten.** [Appendix: statistical elaboration of the experimental results.]—*Arch. Theecult. Ned.-Ind.*, 19, 1, pp. 37–46, 1955.

Statistical data are tabulated with explanatory comments confirming the conclusions summarized in the preceding abstracts regarding the fungicidal control of blister blight (*Exobasidium vexans*) of tea in West Java.

Pound (G. S.) & Helms (Katie). **Effects of temperature on multiplication of Potato virus X in Nicotiana species.**—*Phytopathology*, 45, 9, pp. 493–499, 1 fig., 2 graphs, 1955.

At the Department of Plant Pathology, University of Wisconsin, the multiplication of the clear ring strain of potato virus X described by Ladeburg *et al.* (*Res. Bull. Wis. agric. Exp. Sta.* 165, 47 pp., 1950) was studied in *Nicotiana glutinosa* and tobacco plants grown at air and soil temperatures of 16°, 20°, 24°, and 28° C.

Patterns of virus concentration in relation to air temperatures varied with the season in ultra-violet absorption assays but not in local-lesion assays. Thus, in the winter, virus nucleoprotein concentration, as gauged by optical density [cf. *R.A.M.*, 32, p. 345; 34, p. 344], was closely correlated with symptoms, reaching a maximum at 16° and decreasing with rising temperatures. On the other hand, when assayed by the local-lesion technique, virus concentration was low at 16° and usually highest at 24°, with occasional peaks at 20° or 28°; there was little difference in the numbers of lesions at the three higher temperatures. The data obtained from optical-density and virus-infectivity assays were more closely associated (especially in tobacco) in the spring, when virus protein tended to attain its highest level at 20°, than in the winter. The effects of the virus, including reduction in fresh weight of diseased as compared with healthy plants, were more severe and its concentration was higher in *N. glutinosa* than in tobacco. The influence of soil temperature on symptom expression and virus concentration was similar to, but less pronounced than, that of air temperature.

Hidaka (Z.) & Kiriyama (K.). **Studies on the types of inactivation of purified Tobacco mosaic virus. Experiments with temperature, sonic waves, formalin, extract from Phytolacca americana and bukulin extract from Pachyma hoelen.** —*Virus (Kyoto Univ.)*, 3, 1, pp. 39–50, 1953. [Abs. in *Biol. Abstr.*, 28, 6, p. 1438, 1954.]

In experiments [at Kyoto University, Japan] at various temperatures no change in purified tobacco mosaic virus was observed at 75° C. At 80° or over the number of particles 280 mμ long was greatly reduced [cf. *R.A.M.*, 32, p. 218] and that of short particles accordingly increased, becoming very large at 90° or more. The longer the treatment with sonic waves [cf. 30, p. 633] the greater the reduction in the length of the rods, which segmented, though usually the particles did not disperse. In both series of experiments the shortest particles measured 25 mμ or less and their number increased in advanced treatment stages; at the same time pathogenicity declined and serological activity increased; the short particles were irregularly hexagonal, occasionally appearing to stand upright.

Woolley (D. W.), Schaffner (G.), & Braun (A. C.). **Studies on the structure of the phytopathogenic toxin of Pseudomonas tabaci.**—*J. biol. Chem.*, 215, 2, pp. 485–493, 1955.

At the Rockefeller Institute for Medical Research, New York, the phytopatho-

genic toxin of *Pseudomonas tabacum*, the agent of tobacco wildfire, was shown to be most probably the lactone of α-lactylamino-β-hydroxy-ε-aminopimelic acid [*R.A.M.*, 32, p. 217]. It is formed between the hydroxyl group of the lactic acid residue and the α-carboxyl group of the diaminohydroxypimelic acid. Several degradation products and other derivatives of the toxin were prepared and characterized, and its structural analogy with methionine was confirmed.

Wolf (F. A.) & Wolf (F. T.). **The chemical composition of leaves of diseased Tobacco: ring spot, bacterial wilt, and Fusarium wilt.**—*Phytopathology*, 45, 9, pp. 506–508, 1955.

At the Department of Plant Pathology, University of California, Los Angeles, comparable samples of diseased and healthy leaves of flue-cured tobacco were analysed for total and protein nitrogen [cf. *R.A.M.*, 34, p. 824], total sugars, and petroleum ether extract.

Tobacco ring spot virus was found to cause a significant increase in the nitrogen fraction and a similar decrease in total sugars in the Dixie Bright variety. Gold Dollar leaves infected by bacterial wilt (*Pseudomonas solanacearum*) contained substantially larger amounts of total nitrogen and of petroleum ether extract and significantly smaller quantities of sugars than did those of healthy plants. The wilt caused by *Fusarium oxysporum* var. *nicotianae* was responsible for an important decrease in sugars and an increase of the same order in petroleum ether extract.

The effects of the three diseases on the relative proportions of these components are regarded as consistent with their deleterious influence on the quality of the crop.

McLeod (A. G.). **Resistance of Tobacco varieties to black root-rot.**—*N.Z. J. Sci. Tech.*, Sect. A, 37, 2, pp. 100–102, 1955.

In trials at the Tobacco Research Station, Motueka, New Zealand, 43 tobacco varieties, 22 breeding lines, and three *Nicotiana* species were grown in seedling beds infested with *Thielaviopsis basicola* [*R.A.M.*, 34, p. 214]. Examination of the roots indicated that the following were highly resistant in addition to those already noticed [27, p. 117; 28, p. 5]: *N. debneyii*, *N. debneyii* × *N. tabacum*, Jadel, Delcrest 267, and four breeding lines. Classification of resistance was in close agreement with field results.

Riley (E. A.). **Tobacco anthracnose II: some physiological characteristics of the causal organism in relation to epidemiology. III: experiments on fungicidal control of the disease.**—*Trop. Agriculture, Trin.*, 32, 2, pp. 150–155, 2 graphs; 3, pp. 201–206, 1955.

The author enlarges on the physiological characters of *Colletotrichum tabacum* and their bearing on the control of tobacco anthracnose in Northern Rhodesia [cf. *R.A.M.*, 34, p. 188; 35, p. 92 and next abstract]. On maizemeal agar the optimum pH for growth was 7 and maximum sporulation occurred at pH 9. The fungus grew vigorously between 20° and 30° C.; outside this range the growth rate fell steeply. Tests with anthracnose lesions cut from leaves and placed in closed jars showed that sporulation was extremely sensitive to atmospheric humidity, and spore germination even more so. Humidity is considered to be the most important factor governing the appearance and spread of the disease.

Tobacco seedlings were susceptible immediately after germination, the stems being much less susceptible than the leaves. There was a definite indication of biological antagonism to *C. tabacum* in fresh soil.

Recommendations made to facilitate control include the destruction of weeds and soil disinfection by means other than burning, to assist in maintaining the soil pH within satisfactory limits, to ensure that the soil micro-flora is not destroyed, and to eliminate primary inoculum. Seed should be sown as thinly as is compatible

with a good stand of seedlings. Other measures are early spraying to forestall the secondary phase.

In the greenhouse the following, applied to the soil at 100 ml. per sq. ft. the day before sowing, reduced diseased seedlings from 16·2 per cent. in the untreated to nil: mercury *p*-toluene sulphonilide, thiram, ferbam, ziram, zineb, and 1 in 40 formalin. The number of diseased seedlings was increased by ammonium sulphate plus lime and by methoxyethyl mercuric chloride. Germination was greatly impaired by thiram, ziram, and to a lesser extent zineb, when they were applied alone or with fertilizer at 0·5 gm. per sq. ft. Applied as sprays at 0·08 gm. per ml. twice weekly for three weeks to six-week-old seedlings atomized with a spore suspension they all gave better control than 2–2–50 Bordeaux mixture, though ziram damaged the foliage.

In the third paper an account is given of the progressive selection of fungicides in the laboratory and of greenhouse trials of soil disinfection and protective spraying [loc. cit.]. In laboratory tests the growth of the fungus was entirely prevented when 0·25 per cent. methoxyethyl mercuric chloride (3 per cent. active ingredient), mercury *p*-toluene sulphonilide (7·7 per cent.,) phenyl mercury acetate (2·5), or thiram (75) was added to maizemeal agar, or when 1 per cent. ferbam or ziram (both at 76 per cent. active ingredient) were used; 1 per cent. zineb allowed a trace of growth; ammonia vapour was toxic also.

On nursery sites used in successive seasons infected soil was treated with zineb immediately before sowing; sprays were started three weeks later and continued until the sixth week. The number of surviving seedlings per 500 seeds after soil disinfection (0·5 gm. per sq. ft.) was 101; after spraying (only 0·2 gm. per 100 ml.), 12; and after soil disinfection and spraying, 137; compared with 9 for the untreated. There was no loss from secondary spotting in the series both soil disinfected and sprayed.

In field trials zineb (5 oz. per 30 sq. yds. of seed-bed) was broadcast with fertilizer and applied as a spray (3 oz. per 25 gals. water) at 1 gal. per 30 sq. yds. three weeks after sowing, and at twice this rate after the seedlings had attained 'shilling' size. The disease was absent from plots receiving both soil and spray treatments, but the extremely small amount of infection which developed on the controls and those receiving either soil treatment or spraying (once or twice) made numerical comparisons impossible. However, severe anthracnose on adjacent beds sprayed with 4–4–50 Bordeaux mixture showed the superiority of zineb. In two organized farm trials infected seed-beds pre-treated with zineb in fertilizer and sprayed as above were free from anthracnose, though neighbouring Bordeaux-treated beds were severely affected.

Riley (E. A.). **Tobacco anthracnose : recognition and control.**—*Plant Path. Leafl. Dep. Agric., North. Rhod.* 1, 4 pp., 2 figs., 1955.

This leaflet contains practical information for the farmer on tobacco anthracnose (*Colletotrichum tabacum*). The description of symptoms and many of the recommendations for control have already been noticed [see preceding abstract]. Sterilization of sticks and seed-bed cloths in boiling water is recommended. After pulling, the beds should be seeded with a quick-growing grass to be ploughed in before the end of the rains. If an outbreak occurs affected seedlings should be removed and burnt, the beds being disinfected with a double dose of zineb [loc. cit.].

Lucas (G. B.), Sasser (J. N.), & Kelman (A.). **The relationship of root-knot nematodes to Granville wilt resistance in Tobacco.**—*Phytopathology*, 45, 10, pp. 537–540, 2 figs., 2 graphs, 1955.

At the South Carolina Agricultural Experiment Station the relationship between

infestation by root-knot nematodes and severity of Granville wilt (*Pseudomonas solanacearum*) in the semi-resistant Dixie Bright 101 tobacco variety [cf. *R.A.M.*, 35, p. 47] was investigated. Seedlings grown in soil to which both the bacterium and *Meloidogyne incognita acrita* were added developed symptoms of the disease much earlier and in a more severe form than those exposed to contact with the wilt bacterium only. The principal contribution of the nematodes seemed to be the provision of injuries affording ingress to the bacteria. The effects on the plants of the joint soil infestation were comparable to those induced by inoculation of freshly cut roots with a bacterial suspension. When the bacteria were brought into contact with the roots 24 or 48 hours after wounding, the disease indices 13 days after transplanting were lower (55 and 29, respectively), than when infection took place immediately following injury (100). Evidently therefore, the root tissues heal rapidly and the organisms enter mainly through fresh wounds.

The results of these experiments indicate that root knot should be combated in fields heavily contaminated by *P. solanacearum* in order to gain maximum benefit from the use of wilt-resistant varieties.

SCHRAMM (G.), SCHUHMACHER (G.), & ZILLIG (W.). **Über die Struktur des Tabakmosaikvirus. III. Mitt. : Der Zerfall in alkalischer Lösung.** [On the structure of the Tobacco mosaic virus. Note III: degradation in alkaline solution.]—*Z. Naturf.*, 10 b, 9, pp. 481–492, 6 figs., 1 diag., 5 graphs, 1955.

This is an amplified version of a further contribution to research on the structure of the tobacco mosaic virus [see next abstract] already noticed from another source [*R.A.M.*, 34, p. 489].

SCHRAMM (G.) & ZILLIG (W.). **Über die Struktur des Tabakmosaikvirus. IV. Mitt. : Die Reaggregation des nucleinsäure-freien Proteins.** [On the structure of the Tobacco mosaic virus. Note IV: the reaggregation of the nucleic acid-free protein.]—*Z. Naturf.*, 10 b, 9, pp. 493–499, 5 figs., 5 graphs, 1955.

The results of further electrophoretic studies at the Max Planck Institute for Virus Research, Tübingen, Germany [see preceding abstract], demonstrated that the nucleic acid-free A-protein with a molecular weight of 90,000 prepared from tobacco mosaic virus can be aggregated by adjustment of the hydrogen-ion concentration into rod-shaped particles with extreme dimensions approaching closely to those of the virus itself. Certain intermediate stages are traversed in the aggregation process. Three molecules of the A-protein unite into particles with a molecular weight of 260,000; three particles of this weight form disks 150 Å in diameter, 50 to 100 Å in thickness, 900,000 in molecular weight, and furnished with a central hole. The disks build up into rods of varying length according to the pH of the medium. The chemical, physical, and serological properties of the A-protein agree with those of the X-protein isolated from diseased plants as a natural concomitant of tobacco mosaic virus.

PHILLIPS (D. H.). **Report of the Mycological Department.**—*Rep. States Jersey, 1954*, pp. 28–33, 1955.

This report [cf. *R.A.M.*, 19, p. 67] deals chiefly with investigations on *Didymella* stem rot of tomatoes (*D. lycopersici*) [31, p. 635] from 1951 to 1954, this being the most serious tomato disease in Jersey, and causing heavy losses annually. All mercurials tested gave some control, ethyl mercuric phosphate [27, p. 112] being best, either watered on seedlings before planting out or used as a soil drench in the field, the latter resulting in a significant decrease of the disease during the peak picking period (August to October). Its use, however, calls for great care.

The fungus may be found on newly extracted seed, but does not persist there, and within a year its presence can no longer be demonstrated. The chief source of

infection is on the remains of previous crops [33, p. 266], which should be destroyed by fire, and neither ploughed in nor heaped up, the fungus sporulating heavily in the latter situation.

Strong (M. C.). **Spraying Tomatoes with fixed coppers and carbamates.**—*Quart. Bull. Mich. agric. Exp. Sta.*, 37, 4, pp. 477–485, 3 pl., 1955.

Tests were continued at Michigan State College for evaluating fungicide combinations [cf. *R.A.M.*, 33, p. 55] on the tomato variety Rutgers. In 1953 four fixed copper combinations with ziram gave good control of *Septoria* blight [*S. lycopersici*: 34, p. 189], whereas ziram alone had little effect. Tank-mixes of fixed copper and ziram controlled anthracnose [*Colletotrichum phomoides*: 34, p. 407 and next abstract] much better than alternation of the two. Tank-mix tribasic copper sulphate plus zineb (2 lb. plus 1 lb. in 100 gals.) gave good control of *Alternaria* blight [*A. solani*: 34, p. 691] and anthracnose and a good yield (19 tons per acre), but was not better than with ziram in the mix (19·3). Copper oxide, copper oxychloride sulphate (COCS), tribasic, and cop-o-zink were equally effective (1½ or 2 lb.) in the tank combinations, as were the three types of ziram, Z-C (1 lb.), coro-SDD (1 quart), and vancide 51 ZW (2 lb.). The tank-mix of coro-SDD with tribasic was as effective as with zinc sulphate. Higher yields (19·4) followed vancide F 407 (calcium salts 3 lb.) than vancide 51 ZW (zinc salts) or vancide F 1030 (ammonium salts 3 lb.) which gave 17·1 and 18·4 tons per acre but were less than for tank-mix vancide 51 ZW plus COCS, which gave the highest yield of all (20·2) and the least defoliation (35·5 per cent.), compared with 12·2 tons and 95 per cent. for the unsprayed. In 1954 all sprays significantly increased yield. The tonnage following four kinds of fixed copper with ziram in a tank-mix differed little from that when the same fungicides were alternated (all over 18 tons per acre), but the tank-mix gave better control of anthracnose.

COCS plus vancide Z-65 in a tank-mix gave a significantly higher yield (19·3) than either fungicide alone (17·6 and 17·2). Vancide F 965W (iron salts) alone or in a tank-mix with copper oxychloride sulphate did not give such a good increase as fixed copper alone and the iron salts left black residue on the fruit. Vancide 51 Ca (calcium salts) alone was more effective than zinc or iron vancide alone.

Both coro-SDD plus zinc sulphate and vancide Z-65 controlled anthracnose and early blight. The copper salt of nabam was equal to the manganese salt and both were superior to the zinc salt in increasing yields and controlling disease. The highest yield (19·8) and least defoliation (10·5 per cent.) followed tribasic plus Z-C tank-mix, the figures for the unsprayed being 12·3 and 65·5 per cent. Even when late blight [*Phytophthora infestans*] is not present the control of *Alternaria* and *Septoria* blight may increase tomato yields by 50 per cent. or more.

Wilson (J. D.). **Early Tomato blight can be controlled by using fungicides.**—*Fm Home Res.*, 40, 295, pp. 67–68, 1 fig., 1955.

Early blight (*Alternaria* [*solani*]) has always been the predominant tomato disease in Ohio [*R.A.M.*, 34, p. 470], especially on the staked crops grown along the Ohio river. Under certain conditions it defoliates the crop as quickly as *Phytophthora infestans* and over a ten-year period has caused greater losses. Zineb, followed by maneb, gives the best control on staked tomatoes, whereas on unstaked plants where anthracnose [*Colletotrichum phomoides*: loc. cit. and preceding abstract] becomes important, ziram and maneb are preferable.

In trials over four years at Marietta, Ohio, the average height of defoliation above soil level of staked plants was 12·7 in. for zineb treatment, 13·4 for maneb, 14·9 for fixed copper, and 26·1 for the untreated. For maneb and zineb wettable powder 3 lb. per acre was used, for zineb tank-mix 6 pints nabam plus 1·5 lb. zinc sulphate, and for fixed coppers 6 lb. Spraying should start two to three weeks after

setting out and continue at seven- to ten-day intervals until two weeks before harvest ends.

Wilson (J. B.) & Gallegly (M. E.). **The interrelationship of Potato and Tomato races of Phytophthora infestans.**—*Phytopathology*, 45, 9, pp. 473–476, 1955.

At the West Virginia Agricultural Experiment Station the effects of 29 potato isolates of *Phytophthora infestans*, originating in the United States, Scotland, and Holland and representing 10 physiologic races [*R.A.M.*, 34, pp. 393, 809], were studied on the differential tomato varieties Marglobe, Rutgers, and Bonny Best (susceptible), West Virginia accession 19 and Wisconsin '55', carrying multiple-gene resistance, and accessions 36 and 106 with dominant-gene resistance. Similarly, 16 tomato isolates (all from the United States except two from Canada) belonging to three physiologic races [35, p. 217] were investigated on 12 differential potato hosts, comprising nine selections and the varieties Cobbler, Essex, and Pentland Ace.

The potato isolates fell into the following four groups: (i) weakly pathogenic or innocuous to all the tomato hosts; (ii) pathogenic to the recessive susceptible varieties but harmless to the multiple- and dominant-gene selections; (iii) pathogenic to the recessive and multiple but not to the dominant-gene hosts; and (iv) pathogenic to all the varieties and selections tested. The main difference between the isolates of groups (ii) and (iii) lay in their respective degrees of virulence. No correlation could be established between the characteristics of a given potato race and its effect on tomato hosts or vice versa, and individual isolates of a potato race may react as different tomato races. The tomato isolates behaved similarly to potato races 0, 3, or 4. It is concluded from these results that the tomato genes are distinct from any hitherto recognized in potato; hence the racial features of a particular isolate on the latter host should be considered independently of its characteristics on the former.

Pimenova (Mme A. S.) & Kamenskaya (Mme A. I.). Повышение устойчивости Помидоров против стрика. [Increasing the resistance of Tomato to streak.]—Сад и Огород [*Orchard & Garden*], *1955*, 2, pp. 27–30, 1955.

Experiments from 1952 to 1954 in the vicinity of Moscow, U.S.S.R., showed that applications of borax (5 gm.), potassium acid manganate (5 gm.), 'shenit' (50 gm.), and magnesium sulphate (32 gm.) greatly reduced streak disease of tomatoes (a physiological disorder) [cf. *R.A.M.*, 22, p. 82]. Early sowing (April and beginning of May) under glass increased plant resistance and yields. Overgrown, elongated seedlings subjected to high temperature, insufficient ventilation, and reduced light in greenhouses were severely affected.

Foott (J. H.), Hendrickson (A. H.), & Wilson (E. E.). **Walnut branch wilt.**—*Calif. Agric.*, 9, 10, p. 11, 1 graph, 1955.

Branch wilt (*Hendersonula toruloidea*) of English walnut [*Juglans regia*: *R.A.M.*, 28, p. 494; 33, p. 510] has become particularly destructive in the Tulare county of California [cf. 34, p. 365]. It may be reduced by the annual removal of diseased branches, by the use of nitrogenous fertilizer, and by irrigation during the growing season.

Berry (F. H.) & Gravatt (G. F.). **Walnut bunch disease.**—*Bull. Calif. Dep. Agric.*, 44, 2, pp. 63–67, 4 figs., 1955.

Walnut bunch disease is now the accepted name for the virus disease formerly known as witches' broom or brooming disease [*R.A.M.*, 29, p. 182]. It is widely distributed in the eastern United States, but has so far not been reported elsewhere. Since 1949 six cases of a somewhat similar condition, but lacking the foliar

symptoms, have been observed in California, as a result of which nursery stock from east of the Rocky Mountains was quarantined.

Symptoms [cf. 26, p. 362] include chlorosis, and the bunched wiry shoots which give the disease its name continue active growth in winter. Diseased wood becomes brittle and branches die back, finally resulting in the death of the tree. Affected trees set few, soft-shelled nuts.

Detection in nurseries is often impossible as young trees, though infected, may not show symptoms for a lengthy period. Pruning appears to hasten symptom expression and of 300 healthy-looking nursery walnut seedlings [at Beltsville, Maryland, in 1948] 37 per cent. developed symptoms after pruning, against 4 per cent. of the unpruned controls.

Varieties so far affected include, in order of decreasing susceptibility, Japanese walnut (*Juglans ailanthifolia*) [*J. sieboldiana*], butternut (*J. cinerea*), Persian or English walnut (*J. regia*), and the eastern black walnut (*J. nigra*).

The only means of control is the destruction of diseased trees or in the case of *J. nigra* cutting off diseased branches, and by preventing the export of nursery walnut trees from the eastern United States.

Ramakrishnan (T. S.). **Decline in Cashewnut.**—*Indian Phytopath.*, 8, 1, pp. 58–63, 1 pl., 1 fig., 1955.

During the past few years cashew nut (*Anacardium occidentale*) trees of all ages on infertile, lateritic soils near Calicut on the west coast of southern India have exhibited a decline characterized by progressive defoliation and drying of the twigs during the summer months, and death after two or three years. Many of the fibrous roots were found to be dark brown and dead, and they yielded *Pythium spinosum* [*R.A.M.*, 31, p. 5], identified by its oospores. Symptoms were reproduced in healthy seedlings three weeks after the fibrous roots were inoculated by contact with a culture of the fungus, which was reisolated from the rotted roots. Infection is believed to take place during the rainy season, the symptoms appearing only during the dry season.

Two trees showing initial symptoms revived and produced abundant green foliage six months after the soil at the base had been forked and drenched with Cheshunt compound (1 oz. to 2 gals. water) and later given 100 lb. compost, 2 lb. ammonium sulphate, and 1½ lb. superphosphate.

Tarozzi (G.). **Il punto isometabolico di Endothia parasitica (Murr.) P.J. et H.W. And.** [The isometabolic point of *Endothia parasitica* (Murr.) P.J. & H.W. And.] —*Ann. Sper. agr.*, N.S., 8, 6, pp. 1949–1954, 3 graphs, 1954. [English summary.]

In studies at the Institute of Plant Pathology, University of Pisa, the isometabolic point [*R.A.M.*, 31, p. 508] for the growth of *Endothia parasitica* in a mineral salts solution supplemented by 1 per cent. glucose and 0 to 2 per cent. peptone at 26° C. occurred between pH 4 and 5. Growth was greatest between pH 5 and 7.

Bazzigher (G.). **Über tannin- und phenolspaltende Fermente von Endothia parasitica.** [On tannin- and phenol-splitting enzymes of *Endothia parasitica*.] *Phytopath. Z.*, 24, 3, pp. 265–282, 2 figs., 7 diags., 1955.

At the Federal Institute for Silvicultural Research, Zürich, Switzerland, using the ordinary method of paper chromatography and a special bidimensional technique for the absorption paper chromatography of phenols and tannins, the author demonstrated the presence in *Endothia parasitica* [*R.A.M.*, 33, p. 569] both *in vivo* and *in vitro*, of an adaptive enzyme splitting tannin and gallic acid esters. Evidence is further adduced for the occurrence in cultures of the fungus of a peroxidase peculiar to itself and a constitutive polyphenol oxidase of the laccase type, while

in chestnut there is a host-specific peroxidase and a polyphenoloxidase. The activity of the esterase of *E. parasitica* was stimulated by traces of lithium sulphate, potassium bromide, and iron.

By means of bidimensional paper chromatography a crude extract of chestnut tannins can be separated into 14 to 16 components. Disorganization by the fungus is complete, i.e., the several tannin components and decomposition products are no longer discernible in the chromatogram. The process is accompanied by a significant increase in the toxicity of the tannins of *Castanea sativa* and *C. mollissima*, especially the former, to *Rhizoctonia* [*Corticium*] *solani*.

Italian and Swiss research.—*J. For. Comm., 1952–4*, 23, pp. 21–25, [? 1955].

Among the items of phytopathological interest in this report by T. R. Peace of a visit to Italy and Switzerland during the spring of 1954 is the statement that the worst enemy of young poplars in Europe (but not Great Britain) is *Dothichiza populea* [*R.A.M.*, 34, p. 345], occurring particularly on newly transplanted trees, on large transplants, and after drought.

Chestnut blight disease (*Endothia parasitica*) is spreading steadily in Italy [see following abstract]. New shoots in a coppice near Florence, which was felled in 1946–7 because of heavy infection, are still covered with lesions. In two areas near Genoa the new coppice growth appears to have developed resistance to blight by laying down gum barriers, and the fungus dies in the restricted lesions. This acquired resistance is not confined to trees growing on better soils. At Zürich, Switzerland [see preceding abstract], it has been shown that *E. parasitica* can infect many species of oak [33, p. 569], and successful inoculations on beech [loc. cit.] lead to rapid infection. *Carpinus*, *Corylus*, and elm are virtually resistant.

In the Italian Alps coastal Douglas fir [*Pseudotsuga taxifolia* f. *viridis*] is being severely defoliated by *Phaeocryptopus gaeumanni* [34, p. 193].

A number of Scots pine [*Pinus sylvestris*] strains at the Forestry Research Nursery, Zürich, showed some resistance to *Lophodermium pinastri* [32, p. 49], remaining completely green while sister strains were almost completely brown.

Ribaldi (M.). **Il mal del Castagno ha invaso la zona del Cimino.** [The Chestnut disease has invaded the region of the Cimino.]—*Ital. agric.*, 92, 4, pp. 283–288, 5 figs., 1955.

During the autumn of 1954 a further extension of *Endothia parasitica* was observed in Italy [*R.A.M.*, 34, p. 759] involving both the wild (*Castanea sativa* var. *silvatica*) and edible chestnut trees of the Martone, Gentile, and Precoce varieties on the Cimino mountains in the province of Viterbo. The incidence of infection on the 10- to 15-year-old trees ranged from 9 to 10 per cent. Histological examination of some material containing pustules revealed only the pycnidial stromata of *Endothiella* [cf. 27, p. 114], but the pathogen was reliably identified by its cultural characters on potato and maize meal agars, as well as by the typically fan-shaped aspect of the intracortical mycelium.

Scaramuzzi (G.). **Sul seccume delle foglie d'Ippocastano.** [On withering of the leaves of Horse-Chestnut.]—*Ann. Sper. agr.*, N.S., 8, 4, pp. 1265–1281, 11 figs., 1954. [English summary.]

For some years past horse-chestnut trees growing in many parts of Italy, as well as in Switzerland, have suffered a serious withering of the leaves which has assumed economic importance. The disease was found to correspond to that known in America as leaf blotch, caused by *Guignardia aesculi* (*Phytopathology*, 6, pp. 5–19, 1916) [*R.A.M.*, 5, p. 706]; it is common on both fully grown trees and nursery stock.

Another rather similar but less common disease, confined to mature trees,

generally takes the form of a marginal necrosis of the leaves, which subsequently curl inwards. This appears somewhat later than leaf blotch, and both may occur on the same tree, though generally trees in any given area are affected by one of these diseases only. The branches of trees affected by this second disease have shortened internodes and tend to proliferate, and the leaves are abnormally small. The necrosis is intensified in August and defoliation then begins. Experimental evidence demonstrated that it was not primarily due to lack of water, to unbalanced application of fertilizers, or to mineral deficiencies and its etiology remains obscure.

Campbell (R. N.) & French (D. W.). **A study of mycelial mats of Oak wilt.**—*Phytopathology*, 45, 9, pp. 485–489, 1 fig., 3 graphs, 1955.

The results of further studies in Minnesota during 1953 and 1954 on mycelial mat formation by the oak wilt fungus *Endoconidiophora fagacearum* [*Chalara quercina*: *R.A.M.*, 32, p. 650] showed that mats developed from August to September on *Quercus ellipsoidalis* and *Q. macrocarpa* trees [cf. 35, p. 54] wilting in July, the process being largely completed before the following spring. On trees that began to produce mats during hot weather, formation was scanty and of brief duration, whereas it was profuse and occupied an average period of eight weeks when delayed until late September or October, when the weekly mean temperatures ranged from 55° to 65° F. On trees wilting in August not many mats were formed until the following spring, while few or none developed on trees that had wilted in September. Low rainfall, e.g., 0·7 in. from 1st September to 19th November, did not prevent mat production on standing wilted oaks. On eight trees bearing axe cuts [cf. next abstract] made after the cambium began to turn brown 23 mats were counted. The optimum temperatures for perithecial formation and rapid maturation *in vitro* appeared to lie between 68° and 81°.

Young (H. C.). **Oak wilt is still a threat to Ohio's forests.**—*Fm Home Res.*, 40, 293, pp. 24–27, 2 figs., 1 map, 1955.

Oak wilt (*Endoconidiophora fagacearum*) [*Chalara quercina*: *R.A.M.*, 35, p. 131 and preceding abstract] in Ohio, first discovered in 1950, was found in 55 counties of the State by 1952, causing considerable damage in the South. Besides other vectors [34, p. 192], the ordinary fruitfly, *Drosophila melanogaster*, may transmit the fungus. Infection occurs only through deep lesions caused by storms, insects, birds, or man, or through naturally developed root grafts. Other hosts of the fungus are ash, hickory, *Sassafras*, dogwood [*Cornus*], wild cherry, sour-gum [*Nyssa*], beech, hop-hornbeam [*Ostrya virginiana*], and apple. The fungus has no effect on wood deterioration or on the rate of deterioration by decay fungi. An eradication programme in progress in Ohio seems to have slowed down the spread of the disease.

Persson (A.). **Kronenmykose der Hybridaspe. I. Untersuchungen über Auftreten, selektive Wirkung und Pathogenität des Erregers.** [Crown mycosis of the hybrid Aspen. I. Studies on the occurrence, selective action, and pathogenicity of the agent.]—*Phytopath. Z.*, 24, 1, pp. 55–72, 10 figs., 1 diag., 6 graphs, 1 map, 1955. [English summary.]

In 1950 severe damage was inflicted on ten-year-old hybrid aspens (*Populus tremula* × *P. tremuloides*) at Sofiero in south-west Sweden by the normally saprophytic *Valsa nivea* [cf. *R.A.M.*, 10, p. 418], which in 1954 was equally destructive in a 14-year-old planting of the same host at Ekebo, a short distance away. The cortical tissue round the site of infection turns dark brown to black, the invaded areas later sinking and appearing as shallow depressions on the branches. When the cambial tissue is killed the surrounding parts shrivel and adventitious branches are produced. In the final stage the tree survives solely through the profuse

development of water shoots, which extends the entire length of the stem up to the crown. Field observations indicate that a period of only two to three years elapses between the first recognizable symptoms of infection and the death of the crown.

The fungus made very good growth on the bark and cambial tissue of *P. tremula* × *P. tremuloides* and of *P. tremuloides*, added to a 2 per cent. water agar solution, but its development on material from *P. tremula* was scanty and staling effects were observed. A strain of the pathogen from Sofiero covered a 40 per cent. larger area in a Petri dish test than one from Ekebo. The toxicity of the fungus was studied on cut hybrid aspen plants, 30 to 40 cm. in length, in Erlenmeyer flasks containing a modified Richards's solution inoculated with the Ekebo isolate. Gauged by the extent of foliar necrosis, a maximum of toxin was produced after ten days of culture, followed by a rapid decrease to a minimum at 24 days.

The large dimensions of the hybrid aspen lenticels (average 0·1 sq. mm. as compared with 0·06 sq. mm. in *P. tremula*) suggest a possible channel of ingress for the fungus besides the common courts of entry through insect and mechanical injuries.

Butin (H.). **Über den Einfluß des Wassergehaltes der Pappel auf ihre Resistenz gegenüber Cytospora chrysosperma (Pers.) Fr.** [On the influence of the water content of the Poplar on its resistance to *Cytospora chrysosperma* (Pers.) Fr.]—*Phytopath. Z.*, **24**, 3, pp. 245–264, 5 figs., 3 graphs, 1955.

In further studies at the Institute for Forest Mycology, Hann.-Münden, Germany, on the relationship between disturbances in the water balance of poplar branches and the occurrence of an attack by *Cytospora chrysosperma* [*Valsa sordida*: *R.A.M.*, **33**, p. 388], a loss of between 18 and 22 per cent. of the total water content was found to constitute the infection threshold in sections measuring 10 by 1 cm. Susceptibility was enhanced by the delay in suberization accompanying increased loss of water, the wound periderm forming a barrier to penetration by the fungus. After a successful inoculation a further extension of wound necrosis could be halted by supplying the branch sections with a dilute sugar solution to compensate for the water deficit. In such cases also a cicatrization periderm could be detected at the margin of the necrotic area.

Inoculation experiments on leaf scars gave positive results as long as the vessels of the bundles ruptured in defoliation had not undergone tylosis and could serve as channels of entry for the pathogen.

Itô (K.) & Chiba (O.). **Studies on some anthracnoses of woody plants. I. Overwintering of Gloeosporium kawakamii Miyabe causing the anthracnose of Paulownia tomentosa Steud. II. Glomerella parasitic on Paulownia trees.** – *Bull. For. Exp. Sta. Meguro* 70, pp. 93–101, 1 fig., 1954 [Japanese, with English summary.]; 81, pp. 43–61, 3 pl. (1 col.), 3 figs., 1955. [English, with Japanese summary.]

From studies at the Government Forest Experiment Station, Meguro, Tokyo, Japan, during the winters of 1950–1 and 1951–2 it was determined that the pathogen responsible for anthracnose of *Paulownia tomentosa* in Japan, *Gloeosporium kawakamii* [*R.A.M.*, 13, p. 411], overwintered as mycelium in the petioles of diseased fallen leaves. Conidia were unable to survive the winter temperatures. In early spring new infections were initiated by new conidia from acervuli on the fallen leaves.

In the second contribution it is shown that the *Glomerella* found associated with lesions of *Gloeosporium kawakamii* is referable to *Glomerella cingulata* and was not the unknown ascigerous state of *Gloeosporium kawakamii*.

Terashita (T.) & Takai (S.). **Some researches on the diseases of Eucalyptus in Japan.**—*Bull. For. Exp. Sta. Meguro* 81, pp. 1–18, 1 fig., 3 diags., 1 graph, 1955. [Japanese, with English summary.]

In pot inoculation tests with three damping-off fungi [*R.A.M.*, 31, p. 153] on 14 species of *Eucalyptus*, *Rhizoctonia* [*Corticium*] *solani* isolated from *Abies* and *Cylindrocladium scoparium* [cf. 31, p. 524] from *E. globulus* prevented all the test species from germinating, while a *Fusarium* (isolated from larch and virulently pathogenic to it) was injurious only to *E. globulus*. Seed treatments of uspulun (1 in 1,000 for six or 12 hours or 1 in 500 for six) increased germination, but the lower concentration and ceresan at 8 to 18 gm. caused root injury.

Using Henry and Wagner's method [20, p. 127] it was shown that the threshold concentrations of ceresan required to inhibit mycelial growth of *C. scoparium*, *Fusarium* sp., and *Corticium solani* were 1 in 500, 1 in 100, and 1 in 1,000, respectively. For uspulun the concentrations were 5 in 100,000, 1 in 10,000, and 5 in 100,000, respectively.

In field plots in October, 1954, the germination of *E. globulus* in untreated soil inoculated with *Cylindrocladium scoparium* was 28·1 per cent.; seed and soil treatment with ceresan increased this to 53·6, the corresponding figure for uspulun being 38·2 per cent. The percentages for soil inoculated with *Fusarium* sp. were 28·4, 38·4, and 54, and with *Corticium solani* 3·2, 37·1, and 48·2.

Ribaldi (M.). **Su un deperimento di Robinia pseudo-acacia L. var. umbraculifera DC. f. bessoniana Cowel, dovuto a Phomopsis oncostoma (Thüm.) v. Höhnel.** [On a decline of *Robinia pseudoacacia* L. var. *umbraculifera* DC. f. *bessoniana* Cowel, due to *Phomopsis oncostoma* (Thüm.) v. Höhnel.]—*Ann. Sper. agr.*, N.S., 8, 4, pp. 1197–1212, 5 pl., 3 figs., 1954. [English summary.]

In September, 1950, *Robinia pseudoacacia* var. *umbraculifera* f. *bessoniana* plants, six to eight years of age, which had been planted a few years previously in flowerbeds along an avenue in Ancona, Italy, developed a wilt. The leaves of the affected plants (which had been planted too deeply and had sparse secondary roots, curving upwards) developed elongated, golden-yellow spots and withered and fell prematurely. Most of the larger branches developed a necrosis of the bark, cambium, and wood, and fructifications of *Phomopsis* [*Diaporthe*] *oncostoma* [*R.A.M.*, 13, p. 479] were revealed by the splitting of the periderm.

Laboratory inoculations with this fungus on potted *Robinia* plants (some of which were made receptive by adverse treatments) through wounds in the stem reproduced the symptoms, which were most marked in the weakened plants. Inoculations of unwounded stems were negative.

It is concluded that the fungus is a weak parasite, favoured by adverse environmental conditions. It probably enters the host mainly through pruning wounds, its subsequent spread depending on lowered vitality of the host, especially when caused by prolonged drought. The disease has not been recorded in Italy before.

Leaphart (C. D.). **Preliminary observations on a current outbreak of western gall rust (Cronartium coleosporioides).**—*Plant Dis. Reptr*, 39, 4, pp. 314–315, 2 figs., 1955. [Multilithed.]

Cronartium coleosporioides [cf. *R.A.M.*, 23, p. 156] is causing considerable damage to ponderosa pine (*Pinus ponderosa*) in western Montana, the outbreak apparently having started 15 to 20 years ago. The galls originate in the one- to three-year-old branch wood.

Siggers (P. V.). **Control of the fusiform rust of southern Pine.**—*J. For.*, 53, 6, pp. 442–446, 1 fig., 1955.

Fusiform rust (*Cronartium fusiforme*), mainly on loblolly and slash pines [*Pinus taeda* and *P. caribaea*: *R.A.M.*, 30, p. 592] has steadily become more serious in

southern pine forests of the United States, with the clear-cutting of stands of longleaf pine [*P. palustris*] and regeneration with other species.

The nursery site selected should have a low infection hazard and late sowing (not after the middle of April) should be the rule. Spraying [loc. cit.] is most effective if treatments are deferred until the appearance of rust pustules on oak [29, p. 589] near the nursery, deferred when daily average temperatures are below 56° F., or applied just prior to periods of general precipitation or of high humidity. Culling is economical only if over 5 per cent. of the plantable stock is cankered.

It is also advisable to locate plantation planting sites in areas with low disease potential. Wider use of the resistant *P. palustris* and the apparently immune shortleaf pine [*P. echinata*] is recommended. Increasing the stand density reduces the proportion of stem cankered trees, a 4 by 4 ft. spacing being preferable in areas with high disease intensity. Pruning infected branches with cankers centred less than 15 in. from the stem may prevent serious damage; it should be confined to trees free from stem cankers, preferably two to five years old and under 10 ft. tall.

Franz (J.). **Tannenstammläuse (Adelges piceae Ratz.) unter einer Pilzdecke von Cucurbitaria pithyophila (Kze. et Schm.) de Not., nebst Beobachtungen an Aphidoletes thompsoni Möhn (Dipt., Itonididae) und Rabocerus mutilatus Beck (Col., Pythidae) als Tannenlausfeinde.** [Fir stem aphids (*Adelges piceae* Ratz.) under a fungus cover of *Cucurbitaria pithyophila* (Kze. & Schm.) de Not., together with observations on *Aphidoletes thompsoni* Möhn (Dipt., Itonididae) and *Rabocerus mutilatus* Beck (Col., Pythidae) as Fir aphid predators.]—*Z. PflKrankh.*, 62, 2, pp. 49–61, 3 figs., 6 diags., 1955. [English summary.]

Detailed observations are presented on the occurrence on two 50- to 70-year-old fir [*Abies* sp.] trunks in a mixed planting in Upper Bavaria, Germany, of an extensive, almost unbroken, blackish, crusty cover composed of the fruiting stromata of *Cucurbitaria pithyophila* [cf. *R.A.M.*, 31, p. 384], which afforded partial protection to the aphids (*Adelges piceae*) concealed beneath it from their various insect predators.

Sasaki (T.) & Yokota (S.). **Wood decay of Abies sachalinensis forest in Tokyo University forest in Hokkaido.**—*Misc. Inform. Tokyo Univ. For.* 10, pp. 15–21, 1955. [Japanese, with English summary. Abs. in *For. Abstr.*, 16, 4, p. 529, 1955.]

Fungal decay, chiefly root rots, was present in 87·6 per cent. of the *Abies sachalinensis* trees in the Tokyo University Forest, Hokkaido, Japan, over 40 cm. d.b.h. over the 1·25 ha. surveyed. *Fomes annosus* [cf. *R.A.M.*, 33, p. 391] and *Polyporus schweinitzii* [cf. 22, p. 188] were chiefly responsible but *P. balsameus* [loc. cit.], *F. pinicola*, and *P. sulphureus* were also important. The distribution of root rot indicated that infection spread from tree to tree, damage being less where the stands were less dense.

Murray (J. S.). **Two diseases of Spruce under investigation in Great Britain.**—*Forestry*, 27, 1, pp. 54–62, 1 pl., 1954.

Group dying of spruce [*R.A.M.*, 35, p. 129] in Great Britain is characterized by progressive die-back of the roots and eventual death of the trees in small groups in a stand. The disease, which is predominant in 20- to 30-year-old trees, affects mostly Sitka spruce (*Picea sitchensis*), but sometimes also Norway spruce (*P. abies*). During the three years preceding death the trees bear heavy crops of cone and the height increment is reduced. Thinning of the crown is accompanied by a gradual drop of green needles, culminating in a heavy drop in the middle of the growing season. The affected roots have areas of discoloured tissue in the bast and longitudinal cracks or fissures in the bark up to 4 in. long, often with resin exuding

from the edges. After a few years the spread of the disease in any one group slows, or even becomes static. The timber is not damaged, apart from radial splits due to its rapid drying-out. *Rhizina inflata* [cf. *R.A.M.*, 33, p. 457] has recently been reported on dead or dying roots of affected trees and its possible role is to be investigated.

Top dying, affecting 20- to 50-year-old stands of Norway spruce only [30, p. 6], is characterized by a gradual loss of needles, starting with those of the current year nearest the bud, the tree stands becoming leafless in the following season, and by a reduction in height increment over a period varying from three to five years. The tree dies from the top downwards and there is no emission of resin from the roots. The disease seems to be associated with lack of thinning and may, in some instances at least, be attributable to drought.

JENNISON (M. W.), NEWCOMB (M. D.), & HENDERSON (R.). **Physiology of the wood-rotting Basidiomycetes. 1. Growth and nutrition in submerged culture in synthetic media.**—*Mycologia*, 47, 3, pp. 275–304, 1955.

In a quantitative comparative study of the growth and nutrition of 42 species of common wood-destroying brown- and white-rot fungi in submerged shake culture in synthetic media carried out at the Department of Plant Sciences, Syracuse University, New York [cf. *R.A.M.*, 28, p. 367], growth of most forms reached a maximum in about two weeks, and was usually almost complete in one. Acid was formed in all cases, the pH sometimes falling to 1·5. *Trametes serialis* and *Ptychogaster* [*T.*] *rubescens* required no vitamins, while most of the other fungi were deficient only in thiamine [31, p. 30]. All except four of the species grew in a standard synthetic glucose-mineral medium containing thiamine and any one of a variety of organic or inorganic sources of nitrogen. *Polyporus* [*Poria*] *vaillantii* and *Fomes officinalis* required adenine in addition to thiamine, the former also needing biotin and riboflavin. *Armillaria mellea* required either a medium of lower oxidation-reduction potential than the standard, or one of a quantitatively different composition, and *P. radiculosa* was exceptionally sensitive to the pH resulting from its growth. Generally, growth was greater in organic nitrogen than in ammonium salts. For nine species new media which supported severalfold more growth than did 1 per cent. malt extract [30, p. 117], casein hydrolysate, or the standard medium were developed by altering the constituent proportions of the standard.

There was as much growth, on the average, with valine or glutamine singly in the standard basal medium as with casein hydrolysate. No particular amino acid was essential, each functioning only as source of nitrogen. The various nitrogen sources were not assimilated to the same extent by the fungi; presumably, both environmental factors and intrinsic differences in molecular structure were involved.

LINDGREN (R. M.). **Decay in exterior millwork.**—*J. For. Prod. Res. Soc.*, *1955*, 6, pp. 163–164, 1955.

Following a discussion of the factors affecting decay in exterior woodwork such as window frames and doors, including moisture content and the kind of timber used, the author stated that in tests at the Forest Products Laboratory, Madison, Wisconsin, none of the pine timber stood up to long service under conditions favouring decay. Timber infected with invisible, colourless [mycelial] stages of a number of common moulds absorbed four to five times more water than sound wood. When such affected millwork was treated by dipping in preservative excessive amounts were absorbed [*R.A.M.*, 34, p. 621], thus increasing the cost of preserving and later causing paint failure. The best method of preventing infection in damp timber is by kiln-drying straight from the saw, followed by storage under cover until required. It is concluded that all wood for window frames

should be treated with preservative, preferably with the incorporation of water repellents to give added protection.

FINDLAY (W. P. K.). **The toxicity of borax to wood-rotting fungi.**—*Timb. Technol.*, 61, pp. 275–276, 1953. [Received 1955.]

In experiments at the Forests Products Research Laboratory, Princes Risborough, in 1939 and 1940 borax [*R.A.M.*, 34, p. 213] was found to be toxic to the following wood-destroying fungi: *Lentinus lepideus*, *Coniophora cerebella* [*C. puteana*], *Poria vaporaria*, *Merulius lacrymans*, *P. vaillantii*, *Lenzites trabea*, *Trametes serialis*, *P. xantha*, all on Scots pine, and *Polystictus versicolor* and *Polyporus rugulosus* on beech. The results indicate that a solution containing a minimum of 3 per cent. commercial borax can be used for impregnating timber which is not to be exposed to rain, 5 per cent. or more in a hot solution being used for surface application.

The advantages of borax are that it is non-poisonous, odourless, non-corrosive, and fire-retarding. To avoid discoloration in certain timbers a 50:50 mixture of borax and boric acid is recommended.

SHIBAMOTO (T.) & INOUE (Y.). **Studies on preservative treatments of stem of Bamboo (Phyllostachis edulis Riv.).**—*Misc. Inform. Tokyo Univ. For.* 10, pp. 23–30, 1955. [Japanese, with English summary.]

Of various preservatives tested on an agar medium against *Trichoderma*, *Monascus*, *Mucor*, *Penicillium*, and *Aspergillus* isolated from bamboo [cf. *R.A.M.*, 26, p. 566], sodium penta- and tetra-chlorophenolates were the most effective inhibitors. The 2 per cent. sodium salt was absorbed by cross, radial, and tangential stem sections at rates varying in the proportion of 24:5:1. The amount absorbed was largest under a pressure process, but penetration was less deep than for sodium fluoride or sodium dinitrophenolate. In the hot- and cold-bath process the penetration rate was greater than in the steeping, hot steeping, or vacuum processes. Penetration seemed also to be superior in stems cut in summer.

Sodium DNC and dinitrophenolate were more toxic than other preservatives to *Irpex lacteus* [see next abstract] and *Penicillium* sp. inoculated on stem pieces. Sodium and copper pentachlorophenolates, mercuric chloride, and copper sulphate, though strongly toxic to the decay fungi, were less effective against the moulds. The penta-salt gave better preservation than the tetra-, which in turn was superior to sodium trichlorophenolate.

SHIBAMOTO (T.) & SHOJI (R.). **Studies on the head pressure process (so-called Boucherie process) for wood poles preservation by water-borne preservatives. (1) On the sodium pentachlorophenolate. (2) On the F.D. Group preservative.**—*Misc. Inform. Tokyo Univ. For.* 10, pp. 31–38, 2 figs., 3 graphs; pp. 39–47, 1 fig., 3 graphs, 1955. [Japanese, with English summary.]

In tests with a number of wood samples treated by the Boucherie process [cf. *R.A.M.*, 34, p. 417] high concentrations of sodium pentachlorophenolate [see preceding abstract] were more effective than low. The amount of 1 per cent. solution used was 600 to 900 l. per cu. m. of wood; the pH ranged from 7·5 to 9. The time needed for penetration varied roughly with the length of the pole and roughly reciprocally with the head pressure used: if the height of the head pressure was equal to the length of the pole in metres (L), the time required for treatment was 1·5 L days.

Preliminary tests with FD (containing approximately 80 per cent. sodium fluoride and 8 per cent. DNC or dinitrophenol) showed that the killing concentration on an agar medium was 0·04 per cent. for *Polyporus sulphureus*, 0·05 for *Fomes pinicola*, 0·06 for *Irpex lacteus* [loc. cit.], *Polystictus versicolor*, and *Poria vaporaria*,

and 0·07 for *Schizophyllum commune*. Penetration rate into *Cryptomeria japonica* was about equal that of copper sulphate. FD is best used at 1 per cent. and pH under 7, giving 600 to 900 l. per cu. m. wood, treatment time being L×0·5 to 1 days.

Buro (A.). **Untersuchungen über den Abbau von Kiefern- und Buchenholz durch holzzerstörende Pilze und deren Einfluß auf einige physikalische Eigenschaften des Holzes. Die Veränderung der Pilzresistenz des Holzes durch Tränkung mit Kunstharzlösungen.** [Studies on the disorganization of Pine and Beech wood by wood-destroying fungi and their influence on some physical properties of the wood. The modification of the resistance of wood to fungi by impregnation with synthetic resin solutions.]—*Holz a. Roh- u. Werkst.*, 12, 7, pp. 258–267, 10 graphs; 12, pp. 454–463, 1 fig., 2 graphs, 1954.

In the current series of studies at the Federal Institute for the Mechanical and Chemical Assay of Materials, Berlin-Dahlem, on the physical changes consequent on fungal disorganization of beech and pine wood [*R.A.M.*, 34, p. 559], *Coniophora cerebella* [*C. puteana*] and *Lentinus lepideus* caused progressive reduction in dry volume with weight loss of pine. With beech the volumes increased by 4 and 8 per cent. when *C. puteana* and *Polystictus versicolor* produced weight losses of 15 and 40 per cent., respectively. Further weight losses resulted in a reduction in volume. The maximum amount of linear change occurred uniformly in the tangential direction, followed by the radial; longitudinal modifications were very slight. In every case the quantity of mercury absorbed between 0 and 55 per cent. relative humidity decreased with decreasing weight. At 56 to 100 per cent. the rate of decrease was lower. The most extensive changes occurred between 86 and 100 per cent., within which range absorption increased parallel with weight loss, presumably by reason of the increasing amounts of capillary absorption permitted by the expanded interfibrillar spaces. In pine wood the ratio of tangential to radial swelling was independent of weight loss up to 40 per cent.—an unexpected result since the ray cells were destroyed in the course of biological degradation. In the case of beech the ratio varied in a complex manner.

Sections (3 by 3 by 0·5 cm.) of the same two woods were treated with aqueous solutions of urea and phenolic resins, the contents of which were measured after drying, while determinations were also made of volumetric swelling at various relative humidities up to 100 per cent. and of the growth rates of *C. puteana* and *L. lepideus* on pine and of the former species and *P. versicolor* on beech. Low contents of urea resins (obtained by treatment with 5 per cent. solutions) were found to stimulate fungal growth, while the higher ones resulting from the use of 17·5 and 30 per cent. concentrations of both urea and phenolic resins markedly reduced infection. The following reasons for the enhanced resistance of specimens treated in this way are proposed: mechanical sealing by the resin film on and in the cell wall, toxicity of the resins, and reduction in diameter of the capillaries in the cell walls which the fungal enzymes must traverse.

Zycha (H.). **Probleme des Holzschutzes gestern und heute.** [Problems of wood protection yesterday and to-day.]—*Z. PflKrankh.*, 62, 1, pp. 11–17, 1955. [English summary.]

Modern developments have introduced new complications into the practice of wood protection, which was formerly concerned mainly with the detection and control of destructive fungi or insects. The principal aim of current methods of treatment is the prevention of any deterioration of quality, which necessitates close co-operation between biologists, chemists, and technicians in the organization of a large-scale campaign.

Watson (R. D.). **Galls similar to crown gall and nematode injury produced by 2, 4-D.**—*Plant Dis. Reptr*, 39, 5, pp. 391–394, 4 figs., 1955. [Multilithed.]

Greenhouse experiments at the Idaho Agricultural Experiment Station, Moscow, showed that the root galls associated with reduced growth of vegetables in the field, resembling nematode injury on beet and carrot and crown gall [*Agrobacterium tumefaciens*] on cabbage, were caused by 2,4-D in the irrigation water.

Pimenova (Mme A.). & Maslennikov (I.). Болезни и вредители семенников Капусты и меры борьбы с ними. [Diseases and pests of Cabbage seedlings and their control.]—Сад и Огород [*Orchard & Garden*], *1955*, 6, pp. 30–33, 3 figs., 1955.

The following diseases are reported to be widespread on cabbage seed plants in the U.S.S.R.: black leg [? *Erwinia carotovora*: *R.A.M.*, 28, p. 555], phomosis [*Phoma lingam*: 31, p. 157], downy mildew (*Peronospora* [*parasitica*: 14, p. 277]), black spot (*Alternaria* spp.), grey spot (*Botrytis* sp.) [16, p. 720], slimy bacteriosis [*Bacterium* sp.: 26, p. 574; 30, p. 595], and vascular bacteriosis [*Xanthomonas campestris*: 34, p. 763]. Care should be exercised in selecting healthy seedlings for planting, stumps should be sterilized with hexachlorane (250 gm. per 10 l. solution), and frequent inspection both in field and store should be made to detect infected plants. A 1 per cent. Bordeaux mixture spray applied after flowering gives protection against *A.* spp. and *P. parasitica*. The bottom yellow leaves should, however, be removed first.

Storage places should be disinfected by sulphur fumigation (100 gm. per cu. m.), the walls, shelves, and floors being treated with 40 per cent. formalin (5 l. per 10 l. water) and whitewashed with lime containing 1 per cent. copper sulphate a fortnight before storing selected, healthy seedlings. There should be adequate ventilation and a constant temperature of 0° C. Sterilization of soil under glass by heating at 100° for 20 to 30 minutes or by treating with chloropicrin (60 gm. per sq. m.) or mercuric chloride (10 gm. per glass frame) is recommended. Soil should then be treated with chloride of lime or freshly slaked lime at 500 gm. per glass frame. Disinfection of greenhouses and the soil should not be carried out below 15° following harvesting. Liming the soil is beneficial in preventing the overwintering of disease organisms.

Marlatt (R. B.). **Yellows-resistant Cabbage varieties in Arizona.**—*Plant Dis. Reptr*, 39, 5, pp. 414–415, 1955. [Multilithed.]

In field trials from 1952 to 1954 in the Salt River Valley, Arizona, the cabbage varieties Resistant Golden Acre and Resistant Detroit remained comparatively free from yellows (*Fusarium oxysporum* f. *conglutinans*) [*F. conglutinans*: *R.A.M.*, 34, pp. 85, 581] when grown in heavily infested soil.

Snyder (W. C.), Leach (L. D.), & Sciaroni (R. H.). **Chemical control of clubroot disease of Brussels Sprouts. Chemicals applied in setting water controlled soil borne fungus disease.**—*Calif. Agric.*, 9, 4, pp. 8, 10, 2 figs., 1955.

Club root (*Plasmodiophora brassicae*) on Brussels sprouts, which is serious in San Mateo county, California [*R.A.M.*, 33, p. 459 and following abstracts], spread in one planting from a few diseased plants to the whole of a 20-acre planting in two years.

Following tests on chemical control begun in 1951, seed-bed fumigation with chloropicrin was adopted as a standard practice. In field experiments in 1951 and 1952 hand applications of 1 in 2,000 mercuric chloride (4 oz. to 55 gals.) in the setting water at 0·5 to 0·75 pints per transplant gave good control; in 1953 and 1954 over 250 acres of Brussels sprouts were so treated.

In plot tests at Half Moon Bay in May, 1954, most untreated plants were severely

infected and the roots, invaded by secondary organisms, completely destroyed. Roots treated with two doses of captan were severely clubbed but no secondary invasion had occurred and the root systems were intact. Two doses of pentachloronitrobenzene (PCNB) 75 per cent. wettable powder at 2 to 8 lb. per 100 gals. water and 0·75 pint per plant gave practically equal control at all concentrations, though overgrowths were found on the branch roots at some distance from the crown. The best protection was obtained with mercuric chloride, but all treatments significantly increased yields, particularly PCNB, which is easier to handle and may soon supersede mercuric chloride. Liming the soil in addition appeared to increase control.

Rick (C. M.) & Perkins (D. Y.). **Chemical control of clubroot disease of Brussels Sprouts. Resistance to clubroot disease is goal of breeding project in Brussels Sprouts.**—*Calif. Agric.*, 9, 4, pp. 8–9, 10–11, 1 fig., 1955.

Breeding Brussels sprouts resistant to club root [*Plasmodiophora brassicae*: see preceding and next abstracts] was begun in 1955 in California when various lines of *Brassica oleracea* were tested for resistance in heavily infested soil at Half Moon Bay. One cabbage line remained free from the disease despite severe damage to adjacent plantings. The F_1 hybrid from a cross with Brussels sprouts remained equally free from club root and was successfully back-crossed to Brussels sprouts, about 1 per cent. of the resulting plants being judged excellent and 2 to 3 per cent. of acceptable Brussels sprouts type. Resistance seems to be uncorrelated with horticultural type so that symptomless plants approaching the right type could be selected for further breeding. The initial crosses were used to transfer resistance also to broccoli and cauliflower.

Akesson (N. B.) & Parks (R. R.). **Chemical control of club root disease of Brussels Sprouts. Liquid drop valve for transplanters conserves chemicals and setting water.**—*Calif. Agric.*, 9, 4, pp. 9, 11, 2 figs., 1 graph, 1955.

Economic treatment of Brussels sprouts against club root [*Plasmodiophora brassicae*] with mercuric chloride applied to the roots when transplanting [see preceding abstracts] in California has been made possible by the use of a mechanical transplanter with a simple interrupted drop valve system which measures the setting water solution and allows a rapid and properly synchronized flow.

Thompson (B. D.) & Decker (P.). **The occurrence of two types of hypocotyl discoloration of harvested Radishes.**—*Plant Dis. Reptr*, 39, 5, pp. 416–417, 2 figs., 1955. [Multilithed.]

One type of discoloration affecting radishes at harvest in Florida in 1954 was caused by *Peronospora parasitica* [*R.A.M.*, 34, p. 199]. A second type, of unknown origin, observed during marketing, was characterized by small, sunken spots, frequently coalescing, greyish-brown to black with lighter centres and well-defined margins. The affected internal tissue generally became black. This discoloration was highly sensitive to temperature and did not appear below 50° F.; effective pre-cooling and storage at about 40° is recommended.

Savitsky (V. F.) & Murphy (A. M.). **Study of inheritance for curly top resistance in hybrids between mono- and multigerm Beets.**—*Proc. Amer. Soc. Sug. Beet Tech.*, 8, 2, pp. 34–44, 1954. [Received 1955.]

This paper, which deals with the continuation of investigations in Idaho and Utah previously noticed [cf. *R.A.M.*, 33, p. 196], covers the results of the study of the F_3 and F_4 hybrid lines. Under mild incidence of beet curly top the segregation differed from when it was severe; dominance appeared to grow less with severity and resistance was less than that of the most resistant parent. Linkage between

hypocotyl colour and resistance was confirmed. Resistance in the F_3 lines was improved if the F_2 parents were selected for vigour and quality of fruits. Open pollination of monogerm lines gave better resistance than selfing.

Bennett (C. W.). **Recovery of Water Pimpernel from curly top and the reaction of recovered plants to reinoculation with different virus strains.**—*Phytopathology*, 45, 10, pp. 531–536, 2 figs., 1955.

At the U.S. Agricultural Research Station, Salinas, California, inoculation with 14 strains of beet curly top virus of different degrees of virulence induced a wide range of symptom intensity in *Samolus parviflorus* plants. Strains 1, 2, 3, 4, 6, 7, and 8 were described by Giddings [*R.A.M.*, 24, p. 83], while three of his selections, 22 C, 31, and 66, and four from various sources, designated B, F, P, and T, were included because they appeared to differ mutually and from others already reported. The symptoms of the less pathogenic strains, 2, 4, 7, 31, and F, were confined to vein-clearing, slight leaf-rolling, and little if any stunting, while the virulent 1, 3, 6, B, and more particularly 8 and 22 C, caused severe foliar curling, distortion, chlorosis, and necrosis, and death of part or all of the plant. If the early effects of the disease were overcome the plants made a more or less complete recovery, though the survivors of an attack by the more virulent strains were somewhat less robust than healthy individuals. The experiments yielded no evidence that the strains were attenuated or otherwise modified in recovered plants, the virus concentration in which, however, was very low.

The transmission of virulent strains from recovered to healthy plants by means of dodder (*Cuscuta californica*) [24, p. 136] resulted in the development of severe symptoms. Evidently, therefore, no protective principle was conveyed by the connecting dodder stem from recovered to healthy individuals [cf. 29, p. 548]. The occurrence of additional symptoms denoted that plants which have recovered from one virus strain are susceptible to infection by any other more virulent than the original. By means of a differential host, the S.L. 68 sugar beet variety, it was shown that strain 1 can be superimposed on strain 3, which is about equally virulent, though without causing additional symptoms. Less virulent strains also failed to confer protection against injury by more severe ones. However, plants that had recovered from the effects of inoculation with moderately to highly virulent strains (the former comprising 66, P, and T) were sometimes protected against the full effects of more highly pathogenic ones.

Lüdecke (H.) & Neeb (O.). **Über die Beziehungen zwischen Infektionszeitpunkt und Schädigungsgrad bei der virösen Vergilbungskrankheit.** [On the relations between the date of infection and degree of injury by the virus yellows disease.]—*Zucker*, 8, 12, pp. 259–266, 5 graphs, 1955.

A detailed, tabulated account is given of a field experiment conducted at the Sugar Beet Research Institute, Göttingen, Germany, to determine the connexion between the date of infection and the extent of the damage caused by beet yellows virus [*R.A.M.*, 32, p. 162]. The plots were situated on loess clay amended with a complete fertilizer, and seed of the Kleinwanzleben E sugar beet variety, treated with ceresan and agronax, was sown on 24th March. To minimize the risks of extraneous infection the plots were separated from each other by barriers of hemp reaching to a height of 1·2 to 1·4 m. and sprayed weekly with systox at 0·05 (later 0·1) per cent. [34, p. 829] until a fortnight before each series of inoculations, which were performed on 17th and 31st May, 21st June, 20th July, and 30th August, using *Myzodes* [*Myzus*] *persicae* as the vector. The crop was lifted on 26th October.

A curtailment of the period between inoculation and harvest was found to result in a disproportionately rapid decrease in yield reduction. For instance, the sugar

yield of plants inoculated in mid-May fell by 53·8 per cent. whereas the late August infection caused virtually no decline. The speedy regression in adverse effects accompanying delay in inoculation is attributed primarily to the concurrent decrease in susceptibility of the host with advancing maturity, and only to a slight extent to the correspondingly shorter period of aphid activity. Taking the reductions in sugar yield as a basis, the susceptibility grades of plants inoculated on the first and last dates may be expressed as a ratio of 17:1. In a parallel series of sand culture pot experiments [34, p. 271], in which sowing was on 14th April and harvesting on 14th November, the corresponding ratio was only 2:1, indicating that even late infections may cause heavy losses under relatively unfavourable growth conditions.

The yellow discoloration was limited to a more or less clearly defined zone, the distance of which from the periphery of the leaf rosette increased with the lateness of infection. In the course of the growing season the aspect of diseased stands may change considerably owing to this gradual shifting of the chlorotic zone towards the periphery with the formation of new growth; in cases of early attack the yellow area may even undergo total necrosis.

Kristensen (H. R.). **Værtplanteområde for virusgulsot hos Bederoer.** [Host range for Beet yellows virus.]—*Tidsskr. Planteavl*, 59, 1, pp. 106–117, 5 figs., 1955. [English summary.]

At the Danish State Experimental Station for Plant Diseases and Pests 69 species of plants were tested during 1953–4 for their reactions to beet yellows virus [*R.A.M.*, 34, p. 200], the aphid vector (*Myzus persicae*) being conveyed to the leaves in plastic cages modelled on those described by Kennedy and Booth (*Ann. appl. Biol.*, 37, pp. 451–470, 1950). Infection was contracted by 27 species [cf. *R.A.M.*, 35, pp. 141, 151], including *Gomphrena globosa*, spinach, *Tetragonia expansa*, and a number of weeds (mostly annual) which are believed to be of very little importance as sources of the virus. *Stellaria media*, one of the symptomless hosts which is very widespread and partly biennial, is potentially significant but appears to be relatively unattractive to *M. persicae*, developing only 17 per cent. infection. *Blitum virgatum* proved to be an excellent indicator plant for beet yellows virus, showing vein-clearing, pronounced weakening, and necrosis of the heart leaves after 10 to 11 days. *Trianthema portulacastrum* was also useful for this purpose, a distinctive symptom being silvering of the foliage; the minimum incubation period was 11 to 12 days.

Kovács (A.). **Über die Ursachen der unterschiedlichen Resistenz der Zuckerrübensorten gegen Cercospora beticola Sacc.** [On the causes of the differential resistance of Sugar Beet varieties to *Cercospora beticola* Sacc.]—*Phytopath. Z.*, 24, 3, pp. 283–298, 5 graphs, 1955.

In the course of a study at the Plant Breeding Institute, Sopronhorpács, Hungary, on the reasons for differences in the reaction of sugar beets to leaf spot (*Cercospora beticola*), it was ascertained that the conidia of the fungus germinate more slowly on the leaves of resistant varieties, such as US 215×216, Kleinwanzlebener CR, BETA K-91, and Buszczynski CLR [*R.A.M.*, 35, p. 63], than on those of susceptible ones like PZHR 4, Dobrowitz N, and Ramonyer 1537.

Dew, rain, or distilled water (first sprinkled on the leaves and then collected) from resistant varieties exerted a stronger inhibitory action on conidial germination or in some cases on the growth rate of the germ-tubes than did the corresponding liquids from susceptible ones. No correlation could be established between the number of stomata per unit of leaf surface and resistance to leaf spot, as suggested by Darpoux *et al.* (*Publ. Inst. tech. franç. Better. Ind., 1953*, pp. 13–18, 1953) [34, p. 694].

Conidia of *Alternaria tenuis*, like those of *C. beticola*, germinated more slowly in dew collected from leaf spot-resistant varieties than in that from susceptible ones.

Giardini (A.). **Studi sulla Cercospora beticola in Italia.** [Studies on *Cercospora beticola* in Italy.]—*Industr. saccar. ital.*, 48, 3–4, pp. 68–77, 1955.

In this report, presented to the 17th Congress of the International Institute for Beet Research held at Brussels on the 22nd, 23rd, and 24th February, 1954, experiments on the control of *Cercospora beticola* on sugar beet in Italy [*R.A.M.*, 33, p. 650] are described. During the dry summer of 1952, the wet summer of 1953, and in 1954 when rainfall was normal in the three main beet-growing areas, viz., north of the River Po where infection was consistently high, between the Po and the Reno where it occurred frequently but to a moderate extent, and south of the Reno where it was sporadic and negligible even under favourable conditions, the degree of control obtained was directly proportional to the intensity of attack. During 1952 when vegetative growth ceased during July and August treatment gave yield increases of 10 to 15 per cent. while in 1953 they were about 30 per cent. in areas of severe infection. Both resistant and susceptible plants benefited from the copper treatments, the latter by an increase in root weight and the former in sugar content. Two applications of copper compounds generally suffice when the plants are to be harvested at the end of August or the beginning of September, but three or four are needed for a later harvest, particularly in a wet season. Non-copper products need to be applied three or four times in any case, spraying to begin not later than at the appearance of the first spots of *C. beticola*. Minimum concentrations are 3 per cent. for a copper oxychloride containing 16 per cent. copper and 0·6 to 0·8 per cent. for thiocarbamates containing 70 per cent. of the active principle, of which thiezene Montecatini was of particular interest. Only in dry weather are the best non-copper materials equivalent to the copper. The oxychlorides and sulphates were superior to the oxides.

The importance of treating against *C. beticola* is demonstrated by the fact that of the 240,000 ha. devoted to sugar beet in Italy, about 170,000 ha. are subject to attack. In a year such as 1954 treatment of the 120,000 ha. destined for refining in late August and September and maintained with greater care than the experimental fields would result in a yield increase of 1,000,000 quintals (42 to 48 q. per ha.) sugar.

Agarkov (V. A.). Ржавчина Свеклы и меры борьбы с ней. [Beet rust and its control.]—Агробиология [*Agrobiology, Moscow*], *1955*, 3, pp. 96–105, 2 figs., 1955.

Beet rust (*Uromyces betae*) [*R.A.M.*, 23, p. 465] is very common every year on sugar beet in plots at the Uldavo-Lyulinetskaya Experiment Station in the Vinnitsky region of the U.S.S.R. In experiments carried out from 1949 to 1953, inclusive, on the prevention of the overwintering of teleutospores in the vicinity of sugar beet plantings, spraying, dusting, or immersing beets in a 0·25 to 0·5 per cent. suspension of NIUIF-2 (granosan) were highly effective, a 5- to 10-minute dip giving complete disinfection. It is suitable both for the autumn and the spring treatments. Where infection was slight, 40 per cent. formalin (1 in 300) or 0·3 per cent., thiram were quite effective but a 5- to 10-minute exposure was essential. The granosan wet treatment should be applied with a filler which dissolves in water, or in the form of a 2 to 3 per cent. solution of ethylmercuric chloride.

Other control measures include the removal of plant debris from the field, autumn rejection of highly infected mother beet plants, particularly those with predominating teleutospore pustules, cutting out sprouts, including the fine ones, from the peripheral 'eyes' of stored beets, and planting beets, especially mother beets, at a distance of 1 to 1·5 km. from transplantings.

For controlling the uredo stage of the rust two sprays at 12- to 15-days interval with 1 per cent. Bordeaux mixture, 1 per cent. cupric chloride, or 0·5 per cent. thiram are recommended.

Afanasiev (M. M.) & Morris (H. E.). **Testing Sugar Beet varieties for their resistance to Aphanomyces, Rhizoctonia and Fusarium root rots.**—*Proc. Amer. Soc. Sug. Beet Tech.*, 8, 2, pp. 90–93, 1954. [Received 1955.]

Greenhouse tests were conducted between 1950 and 1953 at Montana Agricultural Experiment Station, Bozeman, on 240 beet varieties for resistance to root rots caused by *Aphanomyces cochlioides* [*R.A.M.*, 35, p. 142 and next abstract], *Rhizoctonia* [*Corticium*] *solani* [33, p. 197], and *Fusarium oxysporum f.* [*F. conglutinans* var.] *betae* [loc. cit.]. No single variety showed a high degree of resistance to all these diseases, though a number did to two of them. Five varieties were highly resistant to *A. cochlioides*, 37 to *C. solani*, and 53 to *F. c.* var. *betae*. Further tests are required for the more precise evaluation of the resistance, using sterilized inoculated soil, which was found to be the most satisfactory standard technique and allowed better comparison; the greenhouse tests proved more uniform and reliable than field tests made at Huntley during the same period.

Doxtator (C. W.) & Finkner (R. E.). **A summary of results in the breeding for resistance to Aphanomyces cochlioides (Drechs.) by the American Crystal Sugar Company since 1942.**—*Proc. Amer. Soc. Sug. Beet Tech.*, 8, 2, pp. 94–98, 1 fig., 1 graph, 1954. [Received 1955.]

The mass selection of sugar beets resistant to the root rot caused by *Aphanomyces cochlioides* [cf. *R.A.M.*, 32, p. 355 and preceding abstract] in the United States has brought about a constant increase in beet production from about five tons per acre in 1944 to over 15 tons from the best variety (2–703) in 1953. In the root rot strain test at Mason City, Iowa, the average production of beet per acre increased from 7·85 tons in 1952 to 10·97 in 1953, while the corresponding average figures for sugar produced were 2,183 and 3,817 lb. per acre. Strain 1–602 ranked highest for root yield and sugar in 1952 and was exceeded only by 2–703 in 1953.

Brandes (J.) & Quantz (L.). **Elektronenmikroskopische Untersuchungen über Buschbohnenviren (Phaseolus-Virus 1 und Phaseolus-Virus 2).** [Electron-microscopic studies on Kidney Bean viruses (*Phaseolus*-Virus 1 and *Phaseolus*-Virus 2).]—*Naturwissenschaften*, 42, 21, p. 588, 1 fig., 2 graphs, 1955.

Electron-microscopic studies on bean mosaic and bean yellow mosaic viruses [cf. *R.A.M.*, 30, p. 507] from *Phaseolus* [*vulgaris*] at the Institute for Agricultural Virus Research, Brunswick, Germany [cf. 34, p. 338], revealed an average length of 751 mμ for 260 (76 per cent.) of the 342 particles of the former examined and one of 750 mμ for 170 (83) of the 206 of the latter. Hence the differentiation of the two viruses on this basis is regarded as impracticable [cf. next abstract].

Van der Want (J. P. H.). **Onderzoekingen over virusziekten van de Boon (Phaseolus vulgaris L.).** [Studies on virus diseases of the Bean (*Phaseolus vulgaris* L.).] Thesis, Agricultural College of Wageningen, 84 pp., 25 figs., 1 diag., 3 graphs, 1955. [English summary.]

Much of the information contained in this important monograph on bean (*Phaseolus vulgaris*) viroses in Holland [see next abstracts] has already been noticed from other sources [*R.A.M.*, 25, p. 89; 28, p. 645; 34, p. 567, *et passim*]. During a visit to Wageningen in 1953, J. W. Oswald, of the University of California, Davis, isolated from a mosaic-diseased white clover plant a virus which induced the development on Beka bean leaves of a mild veinal mottling, the diffuse, pale green spots later becoming encircled by brownish rings. Mechanical transmission was also

successful to red, white, crimson, and alsike clovers, broad bean, and the Rondo and Unica pea varieties. Broad beans reacted by the production of diffuse, irregular, brownish local lesions and a faint systemic mottling, and peas by foliar wilting and shrivelling and chlorosis of the top of the plant. In *in vitro* tests the white clover virus withstood a higher temperature (60° to 65° C.) than either *Phaseolus* virus 1 or 2 [bean mosaic and bean yellow mosaic], its dilution end point was higher (exceeding 10^{-4}), and it was still active after at least three days' storage at room temperature. The white clover virus is presumed to belong to the group of viruses separated by F. Johnson [21, p. 293]. Both bean mosaic and bean yellow mosaic viruses are transmissible by *Myzus persicae* and *Aphis fabae* after brief feeding periods on diseased plants; under comparable conditions white clover mosaic virus could be transmitted only with difficulty by the former species and not at all by the latter.

By means of Ragetli and van der Want's method of paper chromatography [35, p. 1] characteristic particles could be demonstrated by subsequent electron microscopy in the sap of bean plants infected by the RM (roll mosaic) and W (Westlandia) strains of bean mosaic, the TN (top necrosis) and D (New Europe gladiolus) strains of bean yellow mosaic, and by white clover mosaic. The filiform elements present in the sap of plants infected with the two strains of bean mosaic virus tended to aggregate in longer threads than those of white clover mosaic, many of the former showing a remarkable adsorption of amorphous material. A striking feature of the filiform particles in the saps of Servus and Beka beans inoculated with the TN and D strains, respectively, was their aggregation into skeins in association with amorphous material, an inclination which was also noticeable in the RM strain of bean mosaic. No essential difference between the bean mosaic and bean yellow mosaic viruses was, in fact, revealed by the electron-micrograms.

In appendix I are shown the reactions of a number of bean varieties to bean mosaic and bean yellow mosaic viruses in several years' field experiments at Wageningen and in West Friesland. The results of 13 series of experiments on the transmission of the RM and W strains of bean mosaic virus by *M. persicae* and *A. fabae* are presented in appendix II.

Buishand (T.). **Eenige ervaringen met het veredelen van Bonen (I) (Phaseolus spp.) A. Het kruisen van Bonen. B. Ervaringen met het veredelen tot de F_2 generatie.** [Some experiences in breeding Beans (I) (*Phaseolus* spp.). A. The crossing of Beans. B. Experiences in breeding up to the F_2 generation.] –*Meded. Proefst. Groenteteelt* 1, 48 pp., 23 figs., 1955. [English summary.]

One of the objects of the bean (*Phaseolus* spp.) breeding programme initiated in Holland in 1953 was to increase the number of factors for resistance to certain important diseases. In the 73 crosses between *P. vulgaris* and *P. dumosus* (a botanical form of Central American origin), the climbing habit of the latter tended to predominate over the dwarf. Susceptibility to the 'severe' form of *Phaseolus* virus 2 [bean yellow mosaic virus: see preceding and next abstracts] was dominant, and that to the apical necrosis sometimes associated with the disease [loc. cit.] was recessive, as also was field resistance. In general, resistance to anthracnose (*Colletotrichum lindemuthianum*) [see next abstract] was dominant, but breeding operations are complicated by the existence of four groups of physiologic races, designated alpha, beta, gamma, and delta [cf. *R.A.M.*, 5, p. 645; 33, p. 211]. Resistance to halo blight (*Pseudomonas* [*medicaginis* f. sp.] *phaseolicola*) [see next abstract] was recessive.

Wiebosch (W. A.) & Buishand (T.). **Landelijke beproeving van eenige Stamslabonenrassen.** [National trial of some dwarf Bean varieties.] –*Meded. Proefst. Groenteteelt* 2, 36 pp., 1955. [English summary.]

This is a fully tabulated report of over 80 field trials of dwarf bean [*Phaseolus*

vulgaris] varieties conducted in different parts of Holland from 1951 to 1953, in the course of which observations were made on their reactions to various important diseases [cf. preceding abstracts].

Roll mosaic is considered to be a generally more deleterious expression of bean mosaic virus than black vascular disease [*R.A.M.*, 32, p. 229]. The former is prevalent on the widely grown Stringless Double White, sometimes causing substantial crop reductions. Similarly, susceptibility to the form of bean yellow mosaic manifested by apical necrosis, which may practically ruin the crop, is regarded as more undesirable than a susceptible reaction to 'severe' mosaic. Since the virus is not transmissible through the seed, its distribution is largely co-extensive with the presence of its hosts, the proximity of gladioli being particularly dangerous.

Stipple streak (*Nicotiana* virus 11) [tobacco necrosis virus: 34, p. 567] occurs principally in low-lying areas on peat or clay soils, frequently in conjunction with *Fusarium* sp. Under such conditions it may cause heavy yield reductions in susceptible varieties. In one test, for instance, the leading new variety Voorluk produced only 52 kg. per are as compared with 224 for Golden May.

Halo blight (*Pseudomonas* [*medicaginis* f. sp.] *phaseolicola*) is encountered chiefly on calcareous alluvial soils in the provinces of North and South Holland, whereas anthracnose (*Colletotrichum lindemuthianum*) is observed for the most part on diluvial soils. Rust (*Uromyces phaseoli*) [*U. appendiculatus*: loc. cit.] is serious only in the east of the country, where it may decimate summer crops of susceptible varieties, e.g., Furore.

To sum up: while several of the new varieties are resistant to bean mosaic and yellow mosaic viruses, they are liable to infection by other pathogens or are of inferior quality, so that the problem of replacing Double White Stringless (susceptible to viroses in general and to the two above-mentioned in particular, as well as to anthracnose and rust), still remains unsolved.

Schuster (M. L.). **A method for testing resistance of Beans to bacterial blights.**—*Phytopathology*, 45, 9, pp. 519–520, 1 fig., 1955.

At the Nebraska Agricultural Experiment Station the water-soaking technique [*R.A.M.*, 15, p. 537; 21, p. 431; 28, p. 171] has proved effective in tests on beans [*Phaseolus vulgaris*] for resistance to halo and common blights (*Pseudomonas* [*medicaginis* f. sp.] *phaseolicola* and *Xanthomonas phaseoli*, respectively). A De Vilbiss No. 127 atomizer attached to an airline at 15 lb. pressure was used in the greenhouse and a power sprayer at 150 lb. in the field. Inoculation with *P. m.* f. sp. *phaseolicola* by atomization without water-soaking was reported to be most successful when the third trifoliate leaf was unfolding, the primary leaves developing only slight and variable symptoms [19, p. 451]. The water-soaking method, on the other hand, has produced a high incidence of infection on the primary leaves of susceptible varieties.

The use of primary leaves as indicators of halo blight reaction expedites the performance of inoculation tests by about a fortnight. In experiments on five- to nine-day-old plants a temperature of 21° C. proved to be more conducive to symptom expression than 16° or 27°, although infection developed on the susceptible Red Kidney and Asgrow Stringless at 16° on plants of all ages. Mexican Red was resistant at all three temperatures. The inoculation of younger leaves tends to cause the formation of a larger halo and the development of systemic symptoms. Similarly, hydrosis at the site of inoculation is more conspicuous on the primary leaves of younger plants.

In comparative tests by the water-soaking technique on half-expanded leaves, the primary and the third trifoliate responded in the same way to halo blight in Asgrow Stringless, Mexican Red, Arikara Yellow, Giant Stringless, U.S. No. 5 Refugee, and Red Kidney. Tested by the same procedure, a total of 1,786 of the

F_2 progeny of three different crosses and their reciprocals [29, p. 597] gave reasonably comparable results.

Water-soaking was also effective in experiments with *X. phaseoli* on the susceptible Great Northern, Red Kidney, and Scotts Buff Pinto, and on a resistant strain of tepary bean [*Phaseolus acutifolius* var. *latifolius*]. Hydrosis developed in the infected areas of the susceptible varieties and a yellow border appeared round the periphery in about seven days. Small, dry spots were the only symptom in the resistant tepary bean.

Jacks (H.) & Brien (R. M.). **Screening tests with fungicides for control of French-Bean rust (Uromyces appendiculatus (Pers.) Unger).**—*N.Z. J. Sci. Tech.*, Sect. A, 37, 1, pp. 62–67, 1955.

In glasshouse trials at the Plant Diseases Division, Auckland, New Zealand, 37 fungicides were sprayed on potted Fardenlosa beans [*Phaseolus vulgaris*], which were inoculated 24 hours later with a spore suspension of *Uromyces appendiculatus* [*R.A.M.*, 34, p. 213]. The following gave complete protection compared with 819·6 lesions per leaf on the untreated: lime-sulphur (0·5 gals.) plus colsul 40 (2 lb.) in 100 gals. water, cosan (10 lb.), dithane D-14 (containing 1 lb. 25 per cent. nabam per 100 gals.), thirospray (4 lb., 50 per cent. thiram), flit-406 (4 lb., 50 per cent. captan), and nirit (6·7 lb., 15 per cent. dinitrobenzene).

Sinclair (J. B.) & Walker (J. C.). **Inheritance of resistance to Cucumber mosaic virus in Cowpea.**—*Phytopathology*, 45, 10, pp. 563–564, 1955.

Certain strains of cucumber mosaic virus induce a local-lesion reaction in resistant varieties of cowpea, commonly used as an assay host [*R.A.M.*, 32, p. 164], and become systemic in susceptible ones [20, p. 335; 30, p. 135]. At the Department of Plant Pathology, University of Wisconsin, to gain further information on the inheritance of resistance to the virus, crosses were made between the resistant varieties Black, Black Eye, and Dixie Queen, and one susceptible line derived from Black. The reactions of the F_1, F_2, and F_3 progenies demonstrated that resistance is dominant and controlled by a single gene pair. The results of approach-graft experiments with a necrotic strain of the virus from susceptible plants indicated that it did not move into resistant ones sufficiently to become established and that the latter were not systemically hypersensitive.

Anderson (C. W.). **Vigna and Crotalaria viruses in Florida. I. Preliminary report on a strain of Cucumber mosaic virus obtained from Cowpea plants. II. Notations concerning Cowpea mosaic virus (Marmor vignae). III. Notations concerning identification difficulties, indicator plants, possible vector relationships, and virus maintenance.**—*Plant Dis. Reptr*, 39, 5, pp. 345–357, 1955. [Multilithed.]

A new strain of cucumber mosaic virus [cf. *R.A.M.*, 32, p. 298], obtained from plants of cowpea, Lima bean (*Phaseolus limensis*), and *Solanum gracile* in two fields in Florida, tolerated only six hours' ageing and about 1 in 100 dilution. It infected plants of 15 species, including seven legumes. It differed from most other strains of the virus in causing systemic infection in cowpea and remaining essentially latent in cucumber and tobacco.

Blackeye cowpea mosaic virus [a strain of cowpea mosaic virus: 26, p. 524], obtained from cowpea, *Crotalaria spectabilis*, and *Desmodium tortuosum* in the same fields, withstood 60° C. for ten minutes, 1 day's ageing, and 1 in 10,000 dilution. In the laboratory it caused systemic infection in plants of the genera *Vigna*, *Phaseolus*, *Vicia*, *Crotalaria*, *Canavalia*, and *Desmodium*. Local, symptomless infection occurred in zinnia and *Chenopodium*. Preliminary studies indicated that the virus may be aphid-transmissible and seed-borne.

In part III of this series a number of indicator plants for the cowpea and *Crotalaria* viruses are listed and it is suggested that standard varieties of these should be used more widely in future inoculation studies.

Kondo (A.) & Hemmi (T.). **Comparative studies on the anthracnose of Welsh Onion and Onion smudge.**—*Sci. Rep. Shiga agric. Coll.*, 3. pp. 19–35. 1953. [Japanese. with English summary. Abs. in *Biol. Abstr.*, 28. 1. p. 201. 1954.]

The causal fungus of anthracnose of Welsh onion in Japan occurs first on the leaves, forming large greenish or yellowish-grey, later greyish-brown, patches. Symptoms of onion smudge (*Colletotrichum circinans*) [cf. *R.A.M.*, 11. p. 392: 29. p. 550] are confined to the outer scales and neck of the bulb. The morphological differences between the two fungi are so slight that they cannot be separated as species. In culture they varied somewhat in the colour of the colonies and of the aerial mycelium, but they displayed similar tendencies in the formation of conidia and setae. The conidia of the anthracnose fungus germinated at temperatures between 6° and 32° C., the optimum being about 21°. The formation of appressoria was more frequent at the lower temperatures. Germination occurred in a saturated atmosphere with no precipitated moisture, but germinability was less than half that in water drops. The optimum pH for conidial germination was 5 to 7, in the range 2·4 to 9·2. Extracted onion sap contained a toxin or toxins that interfered with germination. Mycelial growth occurred within the range 6° to 36°, the optimum temperature being 24° to 26°: the optimum pH was 5·7 to 6·5, though some growth occurred at pH 7·5 to 7·9, the culture medium becoming alkaline during growth. Inoculation experiments demonstrated that the Welsh onion fungus is pathogenic not only to the leaves of the Koshizu and Kujo varieties of Welsh onion, but also to the bulbs of white onions: tests with the smudge isolate gave similar results.

Van Doorn (A. M.). **Het kunstmatig drogen van Uien ter bestrijding van koprot Botrytis allii (Munn).** [The artificial curing of Onions for the control of neck rot, *Botrytis allii* (Munn).]—*Meded. Dir. Tuinb.*, 18. 4. pp. 250–258. 1955. [English summary.]

Experiments have been in progress since 1952 at the Institute for Phytopathological Research, Wageningen, Holland, to determine the practicability of combating onion neck rot (*Botrytis allii*) [*R.A.M.*, 29. p. 140] by artificial curing. In laboratory tests in which onions were dried at 104° and 95° F. after varying periods of moist storage, the treatment resulted in a material reduction of the rot only when carried out between seven and ten days after harvesting while the leaves were still partly green. Onions cured earlier than seven days after lifting contained too much moisture to permit of thorough drying, while postponement after the tenth day involved the risk, under adverse weather conditions, of penetration of the bulb by the fungus before desiccation of the neck tissue.

Bremer (H.). **'Schmutzflecken' der weißen Zwiebeln.** [Smudge of white Onion.]—*NachrBl. dtsch. PflSchDienst (Braunschw.). Stuttgart*, 7. 8. pp. 140–141. 1 fig., 1955.

An outbreak of smudge disease (*Colletotrichum circinans*) of white onions was reported from a village in the Bonn district of Germany in the wet summer of 1954.

Cox (R. S.). **A preliminary report on diseases of Lettuce in the Everglades and their control.**—*Plant Dis. Reptr.* 39. 5. pp. 421–423. 2 figs., 1955. [Multilithed.]

Downy mildew (*Bremia lactucae*) [*R.A.M.*, 30. p. 259], bacterial soft rots [*Erwinia* spp.), and rib breakdown, resembling brown blight [34. p. 569], present a serious problem to lettuce growers in the Florida Everglades. Of the six fungicides tested

against *B. lactucae*, [an unspecified number of sprays of] zineb gave the best control, resulting in a 60 per cent. increase [in yield] over the untreated, followed by captan (39 per cent.) and ferbam (34 per cent.). Soft rot infections were reduced from 60 per cent. (untreated) to 2 to 9 per cent. by momentary dips of the heads in 50 to 1,000 p.p.m. streptomycin. In one experiment 10, 25, and 50 p.p.m. streptomycin reduced the slime head phase from 85 (untreated) to 6 to 12 per cent.

Stewart (J. K.) & Foster (R. E.). **Observations on rib discoloration and tip burn of Lettuce.**—*Plant Dis. Reptr*, 39, 5, pp. 418–420, 1955. [Multilithed.]

At the Arizona Agricultural Experiment Station lettuce varieties and strains were found to vary considerably in their reaction to rib discoloration and tipburn [*R.A.M.*, 34, p. 569], indicating that less susceptible strains might be developed through selection and breeding. Contrary to the generally accepted view that the Imperial types are more susceptible to tipburn and the Great Lakes types to rib discoloration, Imperial 615 developed less tipburn and showed a more severe form of rib discoloration than certain Great Lakes strains. There was no relationship between the two disorders in either severity or occurrence.

Graham (K. M.). **Seedling blight, a fusarial disease of Asparagus.**—*Canad. J. Bot.*, 33, 5, pp. 374–400, 4 pl., 7 graphs, 1955.

In the spring of 1945 a number of young asparagus plantations near St. Catherines and Vineland, Ontario, were severely affected by seedling blight, hitherto unknown in Canada. Field symptoms included stunting, yellowing, and wilting of the older seedlings, with associated reddish-brown elliptical root lesions. Small lesions frequently occurred on older crown roots at the points of attachment of laterals, while on the primary seedling root they were found anywhere between the hypocotyl and the growing point. Pre-emergence blight was evident by blank spaces in the seedling rows. The causal pathogen, *Fusarium oxysporum* var. *redolens* [cf. *R.A.M.*, 30, p. 307], is unusual among *Fusarium* spp. in being confined to the cortical tissues of the host. Among a number of plants grown in infested soil, only gladiolus and *Asparagus plumosus* developed typical root lesions.

The optimum soil temperature for the disease was 25° to 30° C.; at higher temperatures the fungus was inhibited and emergence of the asparagus more rapid. Below 20° both high and low levels of soil moisture retarded seedling emergence and favoured pre-emergence blight. In the greenhouse the seedling blight was more severe when leguminous residues were incorporated in the soil than with non-leguminous.

Control measures suggested include the selection of a seedbed which has not borne a leguminous crop for at least ten years and is not near a mature asparagus bed. Applied to lightly infested soil arasan (50 per cent. wettable) may give good results.

Kosswig (W.). **Die Symptomatologie der Fusarium-Welken der Gurke (Cucumis sativus L.) und ihr Verhältnis zu den Welkekrankheiten anderer Pflanzen.** [The symptomatology of the *Fusarium* wilts of the Cucumber (*Cucumis sativus* L.) and their relation to the wilt diseases of other plants.]- 148 pp., 44 figs., Hamburg and Berlin, Paul Parey, 1955. DM. 14.

Some of the information in this important monograph, supplemented by a bibliography of 309 references, on the epiphytotic wilts affecting cucumbers in the Stuttgart district of Germany has already been presented from another source [*R.A.M.*, 31, p. 314]. Two main forms of the disease are differentiated, one chronic, marked by foliar chlorosis and caused by *Fusarium solani*, a representative of the Martiella group, and the other an acute wilt attributed to *F. oxysporum* of the Elegans group [cf. 34, p. 127]. The symptoms also include foot rot and damping-off, pre-emergence decay, and dwarfing. *F. oxysporum* leads a parasitic existence in the wood vessels,

whereas *F. solani* primarily attacks the cortex in the root and stem base region. Like other tracheomycoses, the wilt caused by *F. oxysporum* is characterized by extensive browning of the xylem and the presence of mycelium in the vessels, which in an advanced stage of the disease may also contain microconidia. Tyloses and gummous substances, rare in the parts invaded by *F. oxysporum*, are abundant in those attacked by *F. solani*. The cucumber and melon wilts of Germany and Holland [cf. 33, p. 335] and those of watermelon and melon in the United States [cf. 11, p. 557; 17, p. 290, and next abstract] are considered to be identical.

Two categories of hosts are distinguished by their reactions (wilting or chlorosis) to fusarioses and verticillioses (*Verticillium* spp.), the former comprising the Cucurbitaceae, Solanaceae (except potato, in which yellowing predominates), Convolvulaceae, Scrophulariaceae, Pedaliaceae, Malvaceae, Linaceae, Musaceae, and Palmae, and the latter the Cruciferae, Papilionaceae, Rosaceae, Ranunculaceae, Umbelliferae, Chenopodiaceae, Caryophyllaceae, Primulaceae, and Compositae. The vascular-parasitic diseases due to members of the Elegans group constitute a largely uniform assembly, not only as regards symptoms but also in their pathological physiology, while mycological studies further reveal agreement in the mode of infection, colonization, and toxic injury to the host. In other words, the tracheomycoses, regarded from the standpoint of mutual relationships between host and parasite, rather than from that of the life-history of a particular fungus, form an etiologically homogeneous category of diseases. Possibly the fusarioses of the Martiella group are similarly homogeneous, since they too present analogies in external and internal symptoms, in their mode of invasion of the host, and possibly also in the infliction of damage through the operation of toxins. Infection foci are typical of both disease groups, but the representatives of Elegans cause generalized infection and those of Martiella local.

Cucumber was observed to be a new host of *F. moniliforme* [*Gibberella fujikuroi*], the pathogenicity of which was demonstrated by inoculation experiments. It causes a characteristic wither tip of the growing point and surrounding tissue.

Owen (J. H.). **Fusarium wilt of Cucumber.**—*Phytopathology*, 45, 8, pp. 435–439, 2 figs., 1955.

A destructive wilt of cucumbers, attributed to a new form of *Fusarium oxysporum* [cf. *R.A.M.*, 35, p. 72], is reported from the Department of Plant Pathology, University of Florida. It caused damping-off of seedlings and a typical vascular wilt of older plants. In 1949 W.B. Tisdale recorded 1 to 40 per cent. infection in some fields of the 800 acres under the crop in Sumter County, while other stands were so poor as to necessitate ploughing up. On newly cleared land the disease was sporadic and did not appear until the end of the season, suggesting the introduction of infection from old, infested fields through the movement of labourers and equipment. Plants grown for the second or third consecutive season on contaminated soil often developed 25 to 70 per cent. infection by the time of the first picking, entire rows of plants in large areas of the field succumbing to the disease.

In cross-inoculation tests on cucumber, watermelon, and muskmelon seedlings this new form of *F. oxysporum* and also *F. o.* [*F. bulbigenum*] var. *niveum* from watermelon [34, p. 581] were highly pathogenic to their original hosts, while the former also attacked muskmelon [27, p. 307] severely and watermelon slightly; the watermelon isolate infected some varieties of muskmelon, including Smith's Perfect, but was innocuous to cucumber.

v. Koot (Y.) & v. Dorst (H. J. M.). **Een nieuwe virusziekte bij Komkommers.** [A new virus disease of Cucumbers.]—*Tijdschr. PlZiekt.*, 61, 5, pp. 163–164, 6 figs., 1955. [English summary.]

During 1955 a new virosis of the tobacco ring spot type, which had already been

observed the previous year on glasshouse cucumbers in South Holland, extended its range over a wide area. The most pronounced symptoms (masked in fine, warm weather) occur on the fruits, which bear numerous small to medium-sized, pale or greyish, sunken lesions encircled by a dark green, watery margin. The grey-brown spotting of the foliage may be very inconspicuous. Sap-transmission experiments on young cucumber plants resulted in the formation on the leaves of small, brown spots with a pale border and sometimes in a brown discoloration of the veins. French beans [*Phaseolus vulgaris*] inoculated with the virus developed circular, brown, pale-centred spots, mostly on the first pair of leaves, the veins of which turned brown. Several tobacco varieties were also inoculated successfully.

The Dutch cucumber virus is inactivated by ten minutes' exposure to a temperature of 60° C., and its dilution end point also agrees with that of tobacco ring spot; *in vitro*, however, the longevity of the former is greater.

It has been observed in practice that cucumber plants grafted on *Cucurbita ficifolia* are less susceptible to this virus.

Nema (K. G.), Jain (A. C.), & Asthana (R. P.). **Further studies on Aspergillus blight of Groundnut seedlings : its occurrence and control.**—*Indian Phytopath.*, 8, 1, pp. 13–21, 3 figs., 1955.

Further studies at the Department of Agriculture, Madhya Pradesh, Nagpur, India, on the blight of groundnut seedlings caused by *Aspergillus niger* [*R.A.M.*, 31, p. 589] revealed that mycelium must be present for uninjured seeds to be infected, conidia alone producing infection only when the testa was injured. When seeds with broken testas were inoculated with *A. niger* and treated with various fungicides, ceresan, agrosan GN, and fernasan A were most effective against pre-emergence blight and ceresan against the post-emergence phase.

Suhovecky (A. J.) & Schmitthenner (A. F.). **Soybeans affected by early root rot.**—*Fm Home Res.*, 40, 296, pp. 85–86, 1 fig., 1955.

Seedling blight and root rot of soy-bean in Ohio, caused by *Phytophthora* sp., takes many forms. Seed may rot before germination, leaving large gaps in the crop, or seedlings become brown and shrivelled. The most characteristic symptom is the wilting of older plants, even after setting pods. Plants may also be badly stunted with decayed roots from which the decay extends several inches above the soil, or roots of healthy-looking plants may be decayed and internally discoloured. Patches of diseased plants occur generally in poorly drained areas. Arasan, phygon, spergon, and ortho-seed-guard had no effect on the fungus which, however, leaves lucerne, red clover, maize, wheat, oats, and timothy [*Phleum pratense*] unaffected. Soy-beans should not be continuously cropped in affected areas. Of the varieties tested, only Monroe and Blackhawk proved resistant.

Kahn (R. P.) & Latterell (Frances M.). **Symptoms of bud-blight of Soybeans caused by the Tobacco- and Tomato-ringspot viruses.**—*Phytopathology*, 45, 9, pp. 500–502, 11 figs., 1955.

Lincoln and Bansei soy-bean plants inoculated with the tobacco ring spot virus at Camp Detrick, Frederick, Maryland [*R.A.M.*, 33, p. 699], developed several apparently unreported symptoms, including stunting, proliferation of floral buds and trifoliate leaves, pod abortion, abnormally dark green coloration of the foliage, and swollen nodes.

The ring spot virus of tomato, which has been differentiated from that of tobacco by cross-protection experiments [28, p. 492] and electron-microscopic observation [33, pp. 506, 764], also induced typical bud-blight symptoms in greenhouse- and field-grown soy-bean plants. This is believed to be the first record of the tomato ring spot virus as an agent of bud blight in soy-bean.

Desai (M. V.) & Prasad (N.). **A new Colletotrichum from India.**—*Indian Phytopath.*, 8, 1, pp. 52–57, 3 figs., 1955.

A disease characterized by black spots on the leaves, stems, and petioles was observed on guar (*Cyamopsis tetragonoloba*) [*C. psoraloides*] chiefly of the glabrous type, at the Agricultural Institute, Anand, India, during the wet seasons of 1952 to 1953. Hyphae and acervuli with brown setae and spores varying from cylindrical to elongated oval or sickle-shaped were seen in cross sections through infected parts. Typical symptoms were produced on three-week-old guar seedlings atomized with a spore suspension of the organism, which failed to infect other plants. The pathogen was identified as a species of *Colletotrichum* and from the shape and size (17·5 to 28 by 3·5 to 5·2 μ) of the conidia and its host specificity was designated *C. capsici* f. *cyamopsicola* n.f.

Gupta (S. C.) & Sinha (S.). **Two new species of Synchytrium.**—*Indian Phytopath.*, 8, 1, p. 78, 1955.

Synchytrium cyamopsae n. sp., characterized by galls measuring 0·23 to 0·48 (average 0·35) mm. in diameter scattered on the leaves and stems, particularly along the veins, and by smooth, spherical, dark brown resting sporangia 68 to 120 (85·5) μ in diameter, was present on guar (*Cyamopsis psoraloides*) plants near Agra, India, during the rainy season of 1954.

Aoki (J.). **Development of Ascochyta abelmoschi, a fungus attacking Okra pods.**—*Shokubutsu-Byogai-Kenkyu*, 5, pp. 71–73, 1955. [Abs. in *Chem. Abstr.*, 49, 20, col. 14093 *d*, 1955.]

At the National Experiment Station for Silk Thread, Nagano, Japan, the optimum temperature and pH for the growth in pure culture on Czapek's medium of *Ascochyta abelmoschi* from okra [*Hibiscus esculentus*: *R.A.M.*, 33, p. 503] were 28° C. and pH 5 to 6, respectively. Development was retarded at 10° and 30°, and none occurred at 9° with a pH of 3. Soluble starch proved to be the best and glycerol the least suitable of the carbon sources tested. Nitrogen was most easily utilized in the form of potassium nitrate and least readily in that of ammonium chloride.

Van Muijzenberg (E. W. B.). **De beteekenis van de Champignonteelt.** [The importance of Mushroom culture.] –*Meded. Dir. Tuinb.*, 18, 4, pp. 259–265, 1955.

A tabulated survey is given of mushroom cultivation throughout the world. The total annual production of edible species is estimated at 75,000,000 kg. and of wild ones at 25,000,000. The present-day figures (in kg.) for the industry in Holland, Belgium, England, France, and the United States are given as 500,000, 700,000, 15,000,000, 20,000,000, and 30,000,000, respectively. The production costs for various methods of cultivation [see next abstract] are analysed and different standards for comparing their efficiency discussed. The best criterion is considered to be the annual yield in kg. per cu. m. bed space.

De Kleermaeker (E[dith]). **De Champignonteelt in grotten en huizen in Nederland.** [Mushroom cultivation in caves and houses in Holland.] –*Meded. Dir. Tuinb.*, 18, 6, pp. 417–423, 4 diags., 1955. [English summary.]

An outline is given of the methods of mushroom cultivation practised in the caves of South Limburg, Holland, where production has been improved by the adoption of modern methods and the local preparation of manure [cf. *R.A.M.*, 35, p. 71]. Of the various heating systems available, a hot-air stove may be used for a single growing room, but central heating with air-heaters is preferable for a larger number.

Uschdraweit (H. A.). **Das Grünscheckmosaik der Gurke. Chenopodium quinoa als Testpflanze für das Gurkenmosaik.** [The green mottle mosaic of Cucumber. *Chenopodium quinoa* as test plant for Cucumber mosaic.]—*NachrBl. dtsch. PflSchDienst (Braunschw.). Stuttgart.* 7. 9. pp. 150–151. 151–152. 3 figs.. 1955.

An outbreak of green mottle mosaic virus occurred on greenhouse cucumbers [*R.A.M.*, 29, p. 198; 31. p. 531] in Berlin in the summer of 1953. Symptoms are described and care in handling diseased plants is recommended.

In inoculation experiments at the Federal Biological Institute. Berlin-Dahlem. *Chenopodium quinoa* was found to be the most useful test plant for cucumber mosaic virus [33. p. 577], developing necrotic primary lesions with a light centre. a yellow-brown, necrotic ring. and an outer chlorotic zone 2 to 3 mm. wide. It also reacted to inoculation with tobacco mosaic and several unidentified viruses.

Katsura (K.) & Tokura (R.). **Studies on Phytophthora disease of economic plants. (VII). A brown rot of Watermelon caused by Phytophthora capsici Leonian.**—*Sci. Rep. Fac. Agric. Saikyo Univ.* 6. pp. 38–48. 7 figs.. 1954. [Japanese. with English summary.]

In a further contribution to this series [*R.A.M.*. 35. p. 69] a description is given of a brown rot of watermelons occurring in fields in Kyoto. Nara. and Kochi. Japan. since 1952 caused by *Phytophthora capsici* [cf. 21. p. 118]. In inoculation tests the fungus infected fruits of [chilli] pepper. eggplant. fig. and tomato. It could penetrate the unbroken skin of watermelon. cucumber. and squash.

Kundert (J.). **Richtlinien zur Peronosporabekämpfung im Weinbau.** [Directives for *Peronospora* control in viticulture.]—*Schweiz. Z. Obst- u. Weinb.*. 64. 13, pp. 254–255, 1955.

This popular article recapitulates the fungicides available against *Peronospora* [*Plasmopara viticola*] on vine in Switzerland [*R.A.M.*. 34. p. 830] and methods of application. It places particular emphasis on the dangers of late infection and warns against the danger of ending spraying before August.

Cordonnier (R.). **Étude, du point de vue œnologique, des fongicides organiques de synthèse à base d'éthylène-bisdithiocarbamate de zinc et de N-trichloromethylthio-tetrahydrophtalimide employés dans le traitement du mildiou de la Vigne.** [A study. from the œnological point of view. of the synthetic organic fungicides with a base of zinc ethylene bisdithiocarbamate and N-trichloromethylthio-tetrahydrophthalimide used in the treatment of Vine mildew.]—*Progr. agric. vitic.*, 143, 1–2, pp. 8–12, 1955.

Experiments at the Laboratory of Œnological Research and Agricultural Industries, Montpellier, France. on two products used against vine [downy] mildew [*Plasmopara viticola*: *R.A.M.*. 34. p. 700 and next abstract] demonstrated that D, containing 65 per cent. zineb and used at dosages equivalent to those generally employed in vineyard practice, had no effect on fermentation or on the constitution or quality of the wine. S. containing 50 per cent. captan. strongly inhibited the development of wine yeasts. duration of inhibition being a function of the dosage employed. The deposit left by S on the berries may. perhaps. have no effect if the period elapsing between the final treatment and harvesting is sufficiently prolonged (two months in 1952 and 1953). but if this interval is too short it may greatly retard fermentation. Products containing captan are, accordingly, not recommended for late application to vines.

Agulhon (R.) & Amphoux (M.). **Essais de produits de lutte contre le mildiou en 1954.** [Tests with materials for the control of mildew in 1954.]—*Progr. agric.*

vitic., 143, 12–13, pp. 170–179; 14–15, pp. 215–220; 18, pp. 267–275; 19–20, pp. 293–299; 23–24, pp. 350–356, 1955.

In 1954 further spraying tests against vine [downy] mildew [*Plasmopara viticola*: see preceding abstract] were carried out in the experimental vineyard at Beaucaire (Gard, France). Zineb, used as dithane Z-78 (0·5 and 1 per cent.), captan as esso 406 (0·25 and 0·5 per cent.), and two organo-copper products, copper-zineb containing 37·5 per cent. copper and 15 per cent. zineb and zineb-copper (45 per cent. and 12·5 per cent.) were compared with 0·5, 1, 2, and 4 per cent. Bordeaux mixture, the 2 per cent. concentration being the standard. Thirteen applications were made from 14th May to 5th August, inclusive.

Against infection during the 'good season', i.e., during the period of rapid growth up to the end of August, no product gave better results than 2 per cent. Bordeaux, but during this time the disease was causing no appreciable damage. Against late-season infection 2 per cent. Bordeaux equalled 4, 1, and 0·5 per cent. Bordeaux, 0·5 per cent. copper-zineb, and 0·5 per cent. zineb-copper, and all these were better than the two esso 406 formulations. Against *Oidium* [*Uncinula necator*: *R.A.M.*, 34, p. 701] the materials containing zineb alone were inferior to those containing copper, and the more copper the latter contained the more promising were the results.

During the year infection was not severe, and the results obtained do not permit any conclusions to be drawn as to the relative efficacy of the new products during the period of rapid growth of the vines. Against late-season downy mildew it can only be stated that, as in 1952, esso 406 at 0·5 and 0·25 per cent. gave inadequate control, while copper-zineb was doubtfully superior to Bordeaux 1 and 0·5 per cent. [35, p. 77], superiority being noted on one occasion only, at the final weighing of the foliage on 8th November.

As all the new products tested in 1954 are more expensive than Bordeaux the authors do not consider themselves justified in advising growers to abandon the latter, especially at the 2 per cent. concentration. Whereas zineb and captan are so expensive that their general use [locally] is not to be contemplated, even if they should one day prove more effective than Bordeaux, the organo-copper products containing mainly copper, such as copper-zineb, have given very promising results and might be used on a large scale if cheaper or if applicable at a concentration of under 0·5 per cent. The copper-zineb formulation gives an easy spray-mixture to apply, and its general use would considerably reduce the demand for imported metallic copper. Extensive further testing of this material is, however, necessary, under more exacting conditions.

Fontana (P.) & Zampighi (G.). **Attività antiperonosporica, persistenza e traslocazione dell'etilen bis ditiocarbammato di zinco sulla Vite.** [Anti-*Peronospora* activity, persistence, and translocation of zinc ethylene bisdithiocarbamate on Vines.]—*Ann. Chim. appl., Roma*, 44, 12, pp. 988–996, 1 diag., 1 graph, 1954. [Received November, 1955.]

Experiments were conducted in the Piacenza province of Italy during 1953 to determine the persistence on Malvasia vine leaves of compounds based on zinc ethylene bisdithiocarbamate [zineb] used to control *Peronospora* [*Plasmopara viticola*: *R.A.M.*, 34, p. 767] and their subsequent translocation in the plant. The products used were two wettable dusts containing 50 per cent. zineb, in the form of dithane Z-78, one mixed with calcium carbonate and the other with Caffaro dust containing 43 per cent. copper. These were compared with Bordeaux mixture and Caffaro dust containing 16 per cent. copper. Treatments were applied in accordance with the incubation calendar, the zineb compounds being applied at 0·3 per cent. at first and at 0·5 per cent. after the sixth treatment, while the two others were applied first at 1 per cent. and later at 1·5 per cent. The last two plants

in each row were left untreated. Persistence was estimated on about 40 leaves selected at random from each zineb-treated lot immediately before and at intervals after each treatment. Translocation was studied in 10 gm. of detached leaves which had grown following the first zineb treatment and also in some that had been protected from spray deposits since the third treatment. A statistical analysis of disease incidence was made on 14th July.

The fungicide film was unaffected by the chemical action of the atmosphere but was readily removed by heavy rainfall. There was a reduction of 3·5 per cent. in the active principle in ten days during dry weather and of up to 86 per cent. during 29th May to 10th June when 97 mm. of rain fell. Young leaves were found to contain 0·015 to 0·26 mgm. zinc per gm., indicating that considerable translocation took place either of the zineb or of a derivative. The quantity remaining in the untreated shoots stayed fairly constant until the end of June after which it dispersed rapidly probably owing to the vegetative activity of the vine. The percentages of leaves attacked by *P. viticola* in the three lots of the experiment were 13·4, 48, and 8·8 for the first zineb mixture; 11·2, 48·7, and 8·5 for the second; 9·3, 55·1, and 5·9 for the Caffaro dust; 5·7, 36, and 4·9 for Bordeaux, and 100 for each of the untreated controls.

Alghisi (P.). **Sulla degenerazione infettiva della Vite. Parte I. II. III.** [On infectious degeneration of the Vine. Parts I. II. III.]—*Ann. Sper. agr.*, N.S., 8, 3, *Suppl.*, pp. xxxvi–lxxvi; 4, *Suppl.*, pp. i–xvi; 5, *Suppl.*, pp. i–xxxviii, 1954. [English summaries.]

After a brief historical introduction the author reviews at length the available literature on infectious degeneration of the vine [court-noué: *R.A.M.*, 34, p. 342; 35, p. 75, *et passim*] with special reference to the symptoms, both external and internal. The effects produced on the leaves, branches, fruit-clusters, and roots are described in detail in the light of the observations recorded by various French and Italian workers. The nature and structure of the endocellular cordons [cf. 33, p. 464] are fully dealt with, and attention is drawn to Petri's original report of the presence of these bodies in affected vines [7, p. 556].

In part II the author reviews the present state of knowledge concerning rachitism [17, pp. 221, 727] and its causes, including root rots due to *Dematophora* [*Rosellinia*] *necatrix*, *Roesleria pallida*, and other fungi; insect infestation; wilting brought about by premature cessation of growth; over-production; graft incompatibility; and artificial inducement by application of hormones [cf. 29, p. 76]. In a further chapter he discusses the available information on the transmission of court-noué by grafting; through the soil; by means of *Phylloxera* [*vastatrix* f. *radicicola*: 26, p. 226; 28, p. 318]; and by the vegetative multiplication of diseased vines. The effect of climatic conditions upon the disease is briefly noted. The final contribution reviews the theories put forward by various workers as to the nature of court-noué and briefly summarizes the recommendations that have been made for its control. The author concludes that Petri's view of the condition being due to a virus or viruses appears to be the most acceptable, and suggests that regulations should be made to ensure that vines are grown under proper sanitary conditions. A bibliography of over 400 titles is appended.

Fogliani (G.). **Ricerche sperimentali sulla 'degenerazione infettiva' della Vite. Analisi dei sintomi da 'degenerazione' e da altre forme patologiche : descrizione, classificazione, e nomenclatura. Parte I.** [Experimental researches on 'infectious degeneration' of the Vine. Analysis of the symptoms of 'degeneration' and of other pathological manifestations: description, classification, and nomenclature. Part I.]—*Ann. Sper. agr.*, N.S., 9, 1, pp. 189–207, 15 figs., 1955. [English summary.]

In 1949 the author, with the object of making an experimental study of court-

noué disease of the vine [see preceding abstract], began a systematic examination of the vineyards of the Pavia area of the Po valley as part of a wider investigation which includes proofs of the transmission of specific symptoms. In this first part he lists, with brief notes, 24 symptoms observed by him on affected vines, 18 of which were previously accepted as of use in the diagnosis of court-noué by the Italian sub-commission of the International Office of Wine [*R.A.M.*, 27, p. 348] for the study of the disease.

Fischer (H.). **Zur Bekämpfung des Rotbrenners.** [On the control of rotbrenner.]—*Schweiz. Z. Obst- u. Weinb.*, 64, 10, p. 182–184, 1955.

In experiments on the control of rotbrenner [*Pseudopeziza tracheiphila*] in vineyards at Malans, Switzerland [*R.A.M.*, 34, p. 275], belonging to the Cantonal Central Office of Viticulture, where a severe attack of the disease occurred in 1953, four fungicidal applications reduced the number of rotbrenner-infected leaves to the following percentages: 2·6 for Bordeaux mixture plus wettable sulphur (0·8 to 1·5 per cent. plus 0·2) and 0·5 per cent. thiocarbamate combined with copper (cuprosan); 3·8 for Bordeaux mixture alone; 6·8 for copper oxychloride (0·4 to 0·75); and 8·7 for captan (0·25 to 0·5). On those which received only the last two applications (1·2 and 1·5 per cent. Bordeaux, respectively), or only the last, infection was 12·7 and 22·5 per cent., respectively. It is concluded that even seasonable applications of copper oxychloride and captan are inadequate, and that belated applications of effective fungicides will not prevent the outbreak of rotbrenner.

Ruizhkov (V. L.). Систематика вирусов и ее значение для сельского хозяйства. [Systematics of viruses and its importance in agriculture.]—Бот. Журн. [*J. Bot. U.S.S.R.* = *Bot. Zh. S.S.S.R.*], 39, 6, pp. 797–808, 1954.

The author discusses the origin and classification of viruses and reviews Russian and foreign literature published on the subject since 1939.

Kleczkowski (A.). **The statistical analysis of plant virus assays : a transformation to include lesion numbers with small means.**—*J. gen. Microbiol.*, 13, 1, pp. 91–98, 1 graph, 1955.

In the statistical analysis of the results of local lesion tests for virus infectivity [cf. *R.A.M.* 34, p. 832] the transformation $z = \log_{10}(x+c)$ [28, p. 346] is satisfactory only when x (the number of lesions per leaf or half-leaf) is greater than about ten. The new transformation $z = \log_{10} \frac{1}{2}[x+c+\sqrt{(x^2+2cx)}]$ permits the analysis of results with poorly infective inocula, provided that x is greater than about 1·5. The results of the two transformations converge as x increases. Values of z are tabulated to enable the second transformation to be used as arpidly as the first.

Bawden (F. C.) & Kleczkowski (A.). **Studies on the ability of light to counteract the inactivating action of ultraviolet radiation on plant viruses.**—*J. gen. Microbiol.*, 13, 2, pp. 370–382, 1955.

Of seven plant viruses tested at Rothamsted Experimental Station all except tobacco mosaic showed the phenomenon of photo-reactivation, i.e., plants exposed to visible light after inoculation with virus preparations partially inactivated by ultraviolet radiation produced more local lesions than plants kept in darkness [*R.A.M.*, 32, p. 469]. Potato virus X showed the greatest reaction to light and tomato bushy stunt and tobacco necrosis viruses the least, cabbage black ring spot, cucumber mosaic, and tobacco ring spot being intermediate. Photo-reactivation did not occur immediately after inoculation. In the case of potato virus X most particles required about 30 minutes to reach the state in which their ability to infect was affected by light. Once in this state, however, exposure to daylight for 15 minutes gave almost complete photo-reactivation. Some irradiated particles

responded to light of 80 ft. candles; others needed more, but there was no additional response with increases above 600. Sensitivity in potato virus X persisted for about one hour in plants kept in darkness after which the particles appeared to be permanently inactivated.

With antibodies and enzymes a constant amount of absorbed energy decreases the activity of a unit weight by a given fraction but this rule does not apply to plant viruses which lose their infectivity with less absorbed energy than the rule predicts. If viruses are more sensitive because they contain nucleic acid, their sensitivity is not a direct function of this content. Potato virus X has the same content as strains of tobacco mosaic virus but is inactivated by less absorbed energy, and individual strains of the latter also differ in sensitivity.

Van Slogteren (E.). **Serological diagnosis of plant virus diseases.**—*Ann. appl. Biol.*, 42 (*Proc. Jubilee Meeting, London, 13–17 Sept., 1954*), pp. 122–128, 1 pl., 1955.

The author discusses the value of serological methods in the control of virus diseases in stocks of flower bulbs and other horticultural and agricultural crops in the Netherlands [*R.A.M.*, 34, p. 132]. At present, 25 different antisera are available. The practical advantages are indicated, and the principles of the serological technique and methods used to facilitate handling of large quantities of material outlined. The new potato virus S [34, p. 807] was found by this method to be widespread in potato stocks in Europe, causing about 15 per cent. loss. A recently described latent virus in carnations may be the same.

A list is given of the 52 potato varieties grown in Holland of which stocks free from viruses X, S, A, and aucuba mosaic are available.

Hino (I.) & Katumoto (K.). **The virus in the seeds of Tobacco and Radish plants.**—*Bull. Fac. Agric. Yamaguti Univ., 1953*, 4, pp. 199–202, 1953. [Japanese, with English summary.]

By means of the copper sulphate reaction the presence of tobacco mosaic virus in tobacco seed and [? mosaic] virus [*R.A.M.*, 34, p. 69] in radish seed was demonstrated. There is, however, no active virus in the seed or seedlings and seed transmission is not therefore a cause for concern in practice.

Magee (C. J.). **Report on a plant virus disease survey in the territory of Papua and New Guinea—Part I (Manila Hemp).**—*Papua & New Guinea agric. Gaz.*, 8, 4, pp. 12–27, 14 figs., 1954.

Much of the information in the author's survey in 1951 of viroses of banana and abacá (*Musa textilis*) in Papua and New Guinea has already been noticed [*R.A.M.*, 34, p. 138]. In connexion with suggested quarantine measures it is stated that no further introductions of bananas are necessary, since the most important dessert varieties, Gros Michel and Cavendish, are already grown in the Territory and the natives cultivate a wide range of apparently indigenous varieties. Introduction of seed of the valuable abacá variety Tangongon should be sanctioned provided the seedlings are grown in isolation and inspected soon after germination.

Webb (R. E.). **Yellow-net virus disease of some Solanaceous hosts.**—*Phytopathology*, 45, 10, pp. 579–580, 1 fig., 1955.

At Aroostook Farm, Presque Isle, Maine, during the late summer of 1954, four *Physalis floridana* plants that had been used as indicators for potato leaf roll virus [*R.A.M.*, 34, p. 806] developed a marked yellow chlorosis of the vein and veinlets, which was found to be transmissible by *Myzus persicae* to healthy plants of the same species, *P. angulata*, and *Datura stramonium*, inducing after incubation periods of 14, 23, and 27 days, respectively, symptoms closely resembling those of the sugar beet and tomato yellow-net viruses [33, p. 766]. Using *P. floridana* as a virus

source in 183 trials with 10 aphids per test plant, 63 per cent. of the attempted transmissions were successful; with *P. angulata* and *D. stramonium* the percentages were lower. The minimum period for virus acquisition was one hour, and the shortest test feeding time requisite for infection two hours. Once the virus is acquired, an aphid may remain infective for as long as six days. Neither tomato nor sugar beet proved to be susceptible to the yellow-net virus from *P. floridana*.

Ullrich (J.). **Ein Auftreten von Rumex-Virus 2 (Roland) in Deutschland.** [An outbreak of *Rumex* virus 2 (Roland) in Germany.]—*Angew. Bot.*, 29, 2–3, pp. 108–109, 2 figs., 1955.

During the last two years *Rumex obtusifolius*, which grows in abundance in the vicinity of the experimental field of the Neuss-Lauvenburg branch of the German Biological Institute, has shown the indistinct chlorotic mottling characteristic of *Rumex* virus 2 [*R.A.M.*, 32, p. 171]. Sap inoculation experiments gave positive results only on the same species and *R. crispus* after an incubation period of three weeks. The virus was inactivated by 10 minutes' heating at 59° to 60° C.

Stations fédérales d'essais agricoles, Lausanne. Rapport d'activité 1954. [Report for 1954 on the work of the Federal Agricultural Experiment Stations, Lausanne.] —*Annu. agric. Suisse*, (69). N.S., 4, 7, pp. 601–721, 8 figs., 5 graphs, 1955.

The following are among the items of phytopathological interest in this report, prepared on the lines of the previous year [*R.A.M.*, 34, p. 211]. The prevailing low temperatures were conducive to heavy attacks on wheat (especially autumn-sown) by *Ophiobolus graminis*, which caused up to 30 per cent. haulm infection. New foci of dwarf bunt (*Tilletia brevifaciens*) [*T. controversa*] were detected in various parts of French Switzerland, all at altitudes above 620 m., to which the disease is at present confined. More rigorous rules for seed certification are now in operation in respect of dwarf bunt, crops with more than two infected ears per are [= 119·6 sq. yds.] being disqualified. The possibility of direct control of *T. controversa* by soil treatments with products based on BHC and pentachloronitrobenzene, applied after sowing, was indicated by the results of experiments during the period under review.

Three separate physiologic races of *T. caries* were identified.

The copious summer rainfall favoured an epiphytotic of *Puccinia graminis*.

Potato blight (*Phytophthora infestans*) was unimportant during the early part of the season, but Bintje sustained fairly severe damage between 26th July and 13th August, while late varieties, e.g., Voran and Ackersegen, were similarly affected about the 26th August. Zoosporangia were washed into the soil by the heavy rainfall of July and August, resulting in up to 70 per cent. tuber infection. Bordeaux mixture (2 per cent.) was the most effective of the fungicides tested.

The perithecia of apple and pear scab (*Venturia inaequalis* and *V. pirina*) originating on fallen leaves matured from 10th to 20th April, but the wintry conditions at that time delayed the first critical period (temperature of 10° C. and 10 mm. rainfall) until the 26th to 28th. The first lesions appeared on the leaves between 12th and 20th May; profuse conidial production was promoted by the wet and relatively warm weather in August, leading to serious damage from late scab on the fruits, the market value of which was depreciated and the keeping quality impaired.

The efficacy of the fungicides tested against *V. inaequalis* on Beauty of Boskoop apples, giving two pre- and two post-floral treatments at 10- to 15-day intervals, with supplementary applications during the summer and a late one for the prevention of storage scab, was rated as follows: products based on captan (125 to 200 gm. per hl.) 91·5 per cent. Bordeaux mixture (125 to 250 gm. copper sulphate) 91, based on thiocarbamate (150 to 200 gm.) 80·2, lime-sulphur (100 to 200 gm.

sulphur) 75·1, wettable sulphur (140 to 525 gm. sulphur) 74·6, based on thiram (40 to 150 gm.) and on glyoxalidine (125 gm.) both 71·1, and based on benzenedinitrorhodamine 67.

In the canton of Ticino the marketability of peaches was reduced by *Megalocladosporium* [*Fusicladium*] *carpophilum*, which assumed an alarmingly virulent form. The efficacy of 1 per cent. copper oxychloride, 0·5 per cent. captan, 0·25 per cent. ziram, and 0·3 per cent. zineb in tests against peach leaf curl [*Taphrina deformans*: 26, p. 186] was rated at 99·8, 99·5, 99, and 38 per cent., corresponding to 0·08, 0·2, 0·43, and 26·8 per cent. infection, respectively, compared with 43·2 per cent. on the untreated trees.

The numbers of lesions produced by *Pseudopeziza tracheiphila* on Chasselas vine leaves was reduced from 162 and 146 in two untreated plots to none, 0·6, and 0·7, respectively, by the application (on 15th and 26th May, 11th and 22nd June, and 3rd and 14th July) of zineb plus 0·6 per cent. copper, 1 per cent. copper oxychloride, and 0·5 per cent. captan. It is concluded from the results of comparative spraying experiments in 1953 and 1954 that captan and zineb are inferior to copper-containing fungicides in the control of *Plasmopara viticola*, *Uncinula necator*, and *Botrytis* [*cinerea*] on vines. *B. cinerea* proved refractory to all the preparations tested, but Bordeaux mixture impeded its development to some extent, whereas the organic fungicides were useless.

Gregory (E. J.). **Investigations 1953.**—*Bull. Dep. Agric. Jamaica* (N.S.) 53, 163 pp., [? 1954. Received October, 1955.]

Wright (J.). **Annual Report of the Department of Agriculture, Jamaica, for the year ended 31st December, 1953.**—69 pp., 5 figs., 1954. [Received October, 1955.]

The following items occur in the plant pathology section (pp. 67–69) of the bulletin [cf. *R.A.M.*, 33, p. 590] by H. C. James and on pp. 24–25 of the report [cf. 34, p. 136]. New plant diseases recorded during the year include premature tuber formation or 'little potato' in a shipment of Arran Consul, apparently caused by immaturity of the 'seed' accentuated by abnormally early planting and the relatively long dormancy period of this variety; rust (*Uromyces medicaginis*) [*U. striatus*] on lucerne; cherelle wilt of cacao [cf. 34, p. 139]; and scab (*Sphaceloma poinsettiae*) of poinsettia.

A severe abnormal yellowing of Lacatan bananas possibly associated with potassium deficiency caused considerable loss on a property in Portland. A survey showed the condition to be present in a mild form in all banana-growing areas on alkaline soil [cf. 11, p. 25]. At the end of the tenth spray cycle for the control of banana leaf spot [*Mycosphaerella musicola*] copper carbonate alone was giving the best average control at Brimmer Hall, St. Mary, closely followed by 8–10–100 Bordeaux mixture with lorol, while at Burlington, Portland, copper carbonate with sodium succinate was best. The chief conclusions reached by [J.] Rishbeth during his investigations from 1950–52 on Panama disease of bananas (*Fusarium oxysporum* f. *cubense*) [34, p. 655] are summarized (pp. 115–116 of the bulletin). Infection at a given site is determined by the abundance of the fungus and the resistance of the variety cultivated. On light alluvial loams containing abundant inoculum Gros Michel is always diseased, a resistant variety such as 1877 occasionally affected, and the highly resistant Lacatan never affected. Strains of the *Fusarium* obtained from numerous banana varieties can also attack Gros Michel, but isolates from other plants such as oil palm, cotton, or tomato do not. There is also field evidence that particular strains causing wilt of Gros Michel can infect a wide range of banana varieties and that specialized races of the fungus capable of attacking resistant varieties have not yet appeared. Root infection is probably common in Lacatan but wilting is very rare and the stools subsequently recover. Many seedling

varieties such as 1877 are resistant but none so highly so as Lacatan. It is important to test promising varieties on a wide range of sites including some favourable to the disease, before assessing commercial acceptibility. Trenching and the early removal of infected plants delay spread slightly in susceptible plantings. Flood-fallowing [33, p. 213] and soil fumigation seemed unsuited to Jamaican conditions. Applications of lime, phosphate, and potash, alone or combined, or the use of green manures scarcely affected the incidence in Gros Michel. Unless an economically acceptable means of control is found the best solution will be to grow a resistant variety.

Ratoon stunting [34, p. 818] was the most important of the sugar-cane diseases; it is probably fairly widespread on the island.

Pineapple gummosis [cf. 21, p. 408] was prevalent in several localities, apparently confined to the Red Spanish variety.

Grey mould (*Sclerotinia ricini*) [33, p. 632] has become widespread since the castor [*Ricinus communis*] acreage was increased.

The unidentified witches' broom malformations observed on cacao in 1952 [33, p. 590] did not spread to adjacent trees. One tree from which all the brooms were removed in February, 1953, was covered afresh in January, 1954. The 'unknown disease' of coco-nut [loc. cit.] continued to spread slowly in the western part of the island; 2,038 affected palms were cut out during the year.

Department of Agriculture, Kenya, Annual Report 1954. Vol. I.—78 pp., 1955.

In part II of this report [cf. *R.A.M.*, 35, p. 92], dealing with research and specialist services in Kenya (pp. 32–49), it is stated that investigations on the application of copper sprays to coffee trees indicated that low-volume, 'air-blast' spraying at 30 to 60 gals. per acre gives a better under-leaf cover than high-volume spraying at 120 gals. per acre. A final, long-term field trial has been laid down at the Coffee Research Station to compare the two types of spraying for effect on seasonal leaf-fall and crop.

Regarding spraying against [physiological] leaf fall [33, p. 141], trials of rates and concentrations at Solai gave yield results opposite to those of the year before, though the effects were smaller. A similar trial is being carried out at Kitale. The yields for the first year revealed that the only significant interaction was that between copper per tree and rate, suggesting that 2 per cent. at one pint per tree is better than $\frac{2}{3}$ per cent. at three pints. In the second year, season had a significant effect, spraying in May giving better results than in June at the 5 per cent. probability level, and better than in September and than no spraying at the 0·1 per cent. level. Experimental comparison of the effects on leaf fall of 21, 42, and 64 oz. perenox, cupromox, cuprokylt, and blitox per 40 gals. indicated that the effect of concentration tended to change three months after spraying. A field trial was set up at the Coffee Research Station to determine whether leaf-fall control by spraying with a non-copper fungicide (fernide) or with hormones can increase yields. So far, fernide has given the same control as 2 per cent. perenox, but dusting has had very little effect and produced a very poor cover.

The period elapsing between infection by *Hemileia vastatrix* and sporulation was four to five weeks in normal conditions and up to seven in cold weather. Elgon die-back [24, p. 368], present in Kiambu and Solai, does not appear to be due to carbohydrate deficiency, and the question whether a pathogenic organism may be involved should be re-examined.

Pyrethrum [*Chrysanthemum cinerariifolium*], mainly at the Molo Experiment Station, was affected for the first time by a species of *Ascochyta*, which caused some damage. Preliminary spraying trials with copper solutions had no effect on the growth of the fungus. The disease, which affects the buds but not, apparently, the flowers, severely infected certain clones resistant to *Ramularia bellunensis*. Further

allegedly resistant clones were received for testing, and a specially designed, climate-control chamber is now in use.

Blight [*Phytophthora infestans*]-resistant potatoes received in 1953 were further tested and multiplied at high-altitude stations; no new forms of blight were identified. Importations were made from the United Kingdom of small samples of stock seed of recent varieties.

Ratoon stunting of sugar-cane from the Nyanza Province was identified by Dr. Storey, but the presence of chlorotic streak [virus] in suspected material from the same area could not be demonstrated.

Sunflowers in two localities became affected by a condition suspected to be due to the Argentine sunflower virus [30, p. 165], but this was not confirmed.

Wheat take-all [*Ophiobolus graminis*] has greatly increased and is now widespread and serious. *Pyrenophora tritici-repentis* [34, p. 24] occurred in many areas, occasionally causing serious damage. Control of both these diseases depends upon proper rotational cropping, their prevalence being directly due to wheat monoculture. If balanced, rotational farming is not adopted, they will cause progressively greater losses in the higher wheat country. The Kenya wheats 117A and 338.AC. 2. E. 2 have proved of particular value to breeders in North America, and the latter variety has now been named Kenya Famrer.

Maize breeding for resistance to *Puccinia polysora* was continued on the Coast, various homozygous and heterozygous lines being top-crossed to a coast maize to obtain material adapted to local conditions.

Annual Report of the Department of Agriculture, Uganda Protectorate, for the year ended 31st December, 1954.—138 pp., 15 pl., 8 graphs, 1955.

In the botany and pathology section of this report (pp. 102–106) [cf. *R.A.M.*, 34, p. 628] J. D. Jameson states that maize rust (*Puccinia polysora*) has not proved serious on the relatively cool, dry plateau of the Protectorate. The exotic material from which H. H. Storey (in Kenya) recently obtained a gene for resistance to *P. polysora* differs widely in its reaction to streak [virus: 34, p. 448] and may prove to be a source of resistance to this disease also.

No new centre of banana Panama disease [*Fusarium oxysporum* f. *cubense*] infection was reported during the year and there was evidence that the disease is not nearly so serious in Uganda as in the West Indies.

In April, 1954, the stem-pitting symptom of the quick decline virus complex of citrus [C.M.I. map No. 289] was positively diagnosed at Kawanda.

A condition resembling the Argentine virus disease [*R.A.M.*, 32, p. 120 and preceding abstract] was noticed on sunflowers in several places, resulting in the suspension of the export of seed for planting purposes.

The annual survey continued to show a progressive reduction in the incidence of main stem lesions of cotton blackarm [*Xanthomonas malvacearum*] as a result of seed dressings with perecot 45. The percentage infection at Busoga and Lango in plants from seed not dressed was 53; North Mbale dressed for two seasons, 14; South Mbale dressed for three seasons, 10; North Teso dressed for four seasons, 7; the segregated area dressed for five seasons, 4; and in the Mengo District seed not dressed in Ssingo County 65 and in Bulemezi County dressed for one season, 11.

Ratoon stunting virus disease of sugar-cane [C.M.I. map No. 318: *R.A.M.*, 34, p. 577] was diagnosed at Kawanda in December, 1953; the commercial estates are heavily infected.

Annual Report of the Cameroons Development Corporation, 1954.—33 pp., 6 pl. [? 1955.]

In the section of this report [cf. *R.A.M.*, 34, p. 773] dealing with agricultural activities in the British Cameroons (pp. 4–9) it is stated that 932,717 outbreaks of Panama disease of bananas [*Fusarium oxysporum* f. *cubense*] were reported during

the year, and a further 1,689 acres had to be abandoned. The incidence of cacao black pod [*Phytophthora palmivora*] was high, but well controlled by spraying with a mistblower every three weeks. Pepper [*Piper nigrum*] black berry disease [unspecified] was controlled by spraying with Bordeaux mixture. Economic control of banana cigar-end disease (*Trachysphaera fructigena* and *Stachylidium* [*Verticillium*] *theobromae*) was achieved by deflowering the shooting bunches [cf. 34, p. 657].

HEATH (R. G.). **Annual Report of the Department of Agriculture, Malaya, for the year 1954.**—ix+78 pp., 9 figs., 1955.

In this report [cf. *R.A.M.*, 34, p. 707] it is stated (p. 27) that in *in vitro* tests on fungicidal treatment of rice seed, surface sterilization with a 0·1 per cent. mercuric chloride solution in water reduced the percentage of contaminated seed from 55 to 38. In pot tests with an organic mercurial dressing average percentage germination was increased from 82 to 89, while the percentage of diseased seedlings was decreased from 21 to 2. In a preliminary field test seedlings produced from treated seed grew better and more evenly in the nursery than those from untreated seed.

Whereas in previous years leaf blight reported on young oil palm seedlings (p. 29) [34, p. 719] was due to *Curvularia* and *Helminthosporium* sp., this year it was caused by *Colletotrichum* sp. This leaf blight may also be correlated with mineral deficiences.

An experiment on a Cameron Highlands estate regarding the effect of blister blight [*Exobasidium vexans*] of tea on yield (p. 35) was terminated after 15 months' plucking. A moderate attack after pruning caused a yield loss of about 8 per cent.; attacks during plucking did not affect yield.

Die-back (*Cryptosporella eugeniae*) and a form of 'sudden death' (*Valsa eugeniae*) were observed in clove plantations in Penang (p. 37) [35, p. 43]. All plantations inspected were infected by one or both fungi. *V. eugeniae*, which attacks roots and branches, caused the more serious damage, completely killing many trees; *C. eugeniae* attacks aerial parts only, but caused severe die-back; both commonly occurred on the same tree.

Among diseases not previously recorded (p. 44) were leaf spot of pineapple (*Asterinella stuhlmanii*) [19, p. 692] and basal rot of Chinese cabbage (*Sclerotium rolfsii*).

Report of the Division of Mycology and Plant Pathology.—*Sci. Rep. agric. Res. Inst. New Delhi, 1952–1953*, pp. 79–89, 1954.

In the plant pathology section of this report [cf. *R.A.M.*, 34, pp. 348, 771] R. S. VASUDEVA states that during the period under review studies on rust races continued [34, p. 578], the predominant races being 21 and 34 of *Puccinia graminis*, 20 and 63 of *P. triticina*, and 19 of *P. glumarum*. In seedling varietal resistance trials the wheat varieties R.R. 79, E. 1913, and Kenphad 34 were resistant to all the Indian races of *P. graminis* tested individually, and varieties E. 592, E. 616, E. 2140, Gabo × N.P. 165-Pl. 2, Gabo × N.4-Pl. 19, and Gabo × N-4-Pl. 45 to individual races of *P. triticina*. The wheat varieties R.R. 79 and E. 1913 were resistant to *P. graminis* and E. 2140 and Gabo × N.P. 165-Pl. 2 to *P. triticina* in both seedling and adult stages.

Histopathological investigations of wheat tundu disease (*Corynebacterium tritici*) have shown that the bacterium and *Anguillulina tritici* were both present in the growing points of infected wheat seedlings. Infection in plots sown with seed freed from nematode galls by flotation was less than 1 per cent., compared with 5 to 25 per cent. in the untreated.

A severe chlorosis and stunting of wheat and barley, known as molya disease, was shown to be associated with a *Pythium* and a nematode. Inoculations with the *Pythium* alone resulted in stunting, but not yellowing.

An epidemic of sugar-cane red rot (*Colletotrichum falcatum*) [*Glomerella tucumanensis*] occurred in the Punjab, particularly affecting the variety Co. 312. In varietal resistance tests by plug inoculations one variety, Co. 795, was resistant. Twenty-two varieties inoculated with smut (*Ustilago scitaminea*) were resistant, developing less than 5 per cent. infection, compared with as much as 90 per cent. in susceptible varieties. *U. scitaminea* caused 30·62 and 40·49 per cent. reduction in yield in the sugar-cane varieties Co. 312 and Co. 313, respectively, when the setts were infected at the time of planting, but 73·3 when setts from smutted cane of Co. 313 were planted.

Collections of linseed rust (*Melampsora lini*) yielded the Indian races 1, 3, and 4. In varietal resistance tests 23 linseed varieties were resistant in the adult stage and 15 in both seedling and adult stages to a mixture of the four Indian races of *M. lini*. The losses in yield of linseed due to *M. lini* on a 100 plant basis were 38·2 and 43·8 per cent. for moderate and heavy infection in N.P. 1, and 33·8 and 35·4 on a 1,000 grain weight basis.

The pigeon pea varieties N.P. 41, C. 15 W.E., and C. 38–3–1 were resistant both in the field and in pots to infection by *Fusarium udum*.

In experiments with oospores of *Sclerospora graminicola* [34, p. 295] from bajra [*Pennisetum typhoides*], 10 per cent. germination was obtained following nine months weathering. The varieties T55, A1/3, Ka, AKP1, and No. 207 showed only traces of *S. graminicola* infection in the field, while Co. 1, Co. 2, *Setaria italica* variety White, teosinte [*Euchlaena mexicana*], and the maize variety N.P. 2 were free from infection.

The passage through soil of a culture filtrate of *Bacillus subtilis* resulted in a loss of antibiotic activity. This antibiotic was extracted by adsorption on kaolin and elution with ethyl alcohol, found to be thermostable, giving positive biuret and xanthoproteic reactions, and active at pH 4·5 to 9·8 At a concentration of 1 : 10,000 the growth of *F. udum* was inhibited, also the germination in water of *Alternaria solani* spores [34, p. 665]. At higher concentrations the antibiotic inactivated petunia, chilli, and *Vinca rosea* mosaic viruses *in vitro* and acted systemically in tomato plants against *A. solani*.

An *Alternaria* isolated from a leaf spot of brinjal [eggplant] was able to infect potato, tomato, eggplant, *Lycopersicon pimpinellifolium*, and *Hyoscyamus niger*. The isolate was similar to *A. tenuis* morphologically but not pathogenically.

At least two distinct strains of potato bacterial brown rot, *Pseudomonas solanacearum* [34, p. 517], occur in India. A new species of *Xanthomonas* was found causing a leaf spot of pomegranate [see below, p. 283].

In the section on plant viruses (pp. 85–88) it is stated that a mutant of *Cucumis* virus 2c [cucumber green-mottle mosaic virus] produced irregular yellowish spots on bottle-gourd [*Lagenaria vulgaris*] and was more virulent than the type strain. *Crotalaria juncea* mosaic virus was carried symptomlessly by *Petunia hybrida* and induced local necrotic lesions on *Cyamopsis tetragonoloba* [*C. psoraloides*].

Hibiscus rosa-sinensis leaf curl virus was transmitted to *H. rosa-sinensis* and hollyhock by grafting and to *Abelmoschus* [*H.*] *esculentus*, *H. tuberculatus*, and *H. manihot* by white fly (*Bemisia tabaci*). Yellow vein mosaic virus of bhindi [*H. esculentus*] was transmitted to *H. manihot*, *A. moschatus* [*H. abelmoschus*], and *H. cannabinus* by grafting and by *B. tabaci*, and to *H. sabdariffa* by grafting.

Chilli mosaic virus was shown to be transmitted both by *Aphis gossypii* and by sap. Chilli leaf curl was graft-transmitted to chilli, tobacco, and tomato.

The thermal death point of eggplant mosaic virus lay between 60° and 70° C., but the virus was still infective after 15 days' storage at 35° F.

The sesame phyllody virus [35, p. 92] was more severe in the early crop than in the late. Leaf curl of sesame was transmitted by grafting and by *B. tabaci*.

Pumpkin mosaic virus [31, p. 275] was inactivated *in vitro* by one hour in 90

per cent. ethanol at 35° C. or by heating to 50° for ten minutes. The virus was transmitted by *Aphis gossypii*. Yellow vein mosaic of pumpkin was transmitted by white fly [? *Bemisia* sp.] to vegetable marrow and cucumber, the vector needing 15 minutes to acquire the virus, which required a minimum incubation period in the vector of nine hours.

The host range of papaw mosaic virus was shown to include cucumber, vegetable marrow, muskmelon, watermelon, *Luffa acutangula*, *Lagenaria vulgaris*, and *Trichosanthes anguina*.

The first outbreak of cotton small-leaf [virus] disease for 12 years was observed on Hagari cotton (*Gossypium herbaceum* var. *frutescens*) and RK19×NS12. Four varieties from the old world were infected by grafting.

Transmission of banana mosaic virus [cf. 31, p. 119] was only successful to cucumber. The vector was not found. Maize mosaic virus was transmitted to maize by *Aphis maidis* and *A. gossypii*, and to maize and sorghum by *Myzus persicae*.

Preliminary results suggested that *Datura inoxia* distortion mosaic virus [32, p. 627] was the cause of gooseberry mosaic. Other hosts included cowpea, tobacco, and *Capsicum frutescens*.

Eggplant little leaf virus [cf. 33, p. 582] was transmissible by even a single jassid (*Eutettix phycitis*). The incubation period in the vector of the virus causing 'katte' of cardamom [*Elettaria cardamomum*: 34, p. 612 and next abstract] was one hour. Leaf curl of *Saponaria vaccaria* was transmitted by grafting and found to be distinct from tobacco leaf curl [34, p. 350].

Report of the Division of Mycology and Plant Pathology.—*Sci. Rep. agric. Res. Inst. New Delhi, 1953–1954*, pp. 87–99, 1955.

In the plant pathology section of this report [see preceding abstract] R. S. Vasudeva notes that as a result of further studies on the physiologic races of cereal rusts, race C of *Puccinia graminis* was isolated from the wheat variety Kenphad 28 for the first time. Indications of a new race of *P. triticina* have been obtained. *P. graminis* race 34 is increasing, while race 42 is less prevalent. Colour mutation in *P. graminis* race 15 C has been observed. In the search for collateral and alternate hosts of cereal rusts, *Vulpia myuros*, but not *Briza minor*, was successfully infected with races 15, 15 C, 24, 42 B, and 194 of *P. graminis*, giving the resistant type of reaction. In the Western Ghats some evidence of oversummering of *P. graminis* and *P. triticina* was obtained.

In wheat seedling varietal resistance trials, using individual races of *P. graminis*, the varieties E. 2025, N.P. 789, and N.P. 790 were susceptible only to race 122, and E. 931 to race 15 C. Rust incidence was not affected by differing cultural and manurial treatments.

Out of 125 wheat varieties tested for loose smut, *Ustilago tritici* [*R.A.M.*, 33, p. 594], 72 were resistant. Artificial inoculation of the wheat varieties N.P. 770, N.P. 801, and N.P. 809 with a culture of *Tilletia foetida* from Europe resulted in 41, 80, and 67 per cent. infection, respectively. An epiphytotic of *Neovossia indica* occurred on wheat in Delhi State and some neighbouring districts of the Punjab. Seed treatment of the variety N.P. 718 with agrosan GN lowered the percentage of disease in the subsequent crop.

In varietal resistance tests of adult barley plants, B. 70 and B. 75 were resistant to a mixture of all ten races of yellow rust, *P. glumarum*.

The perithecial state of the sugar-cane red rot fungus *Physalospora* [*Glomerella*] *tucumanensis* was found at Delhi, Karnal, and a few localities in the Punjab, and the connexion with the conidial state was established. No evidence of physiologic specialization in 32 isolates of *G. tucumanensis* was obtained. The application of sulphur at planting had no effect on resistance to red rot. The first ratoon crop

generally had a higher incidence of the disease than either the plant crop or the second ratoon.

A new race of linseed rust, *Melampsora lini*, has been collected in the Punjab, differing from others in the reaction on the Argentine selection C.I. 705–1. The wild species *Linum trigynum*, *L. marginale*, *L. africanum*, *L. angustifolium*, and *L. coeruleum* were immune from the Indian races of *M. lini*.

Field and pot experiments showed that the pigeon pea variety N.P. 69 × U.P. 132, 3–2–2–2 was resistant to *Fusarium udum*. The variety N.P. 41 has shown high resistance since 1945.

In further studies on *Sclerospora graminicola* on bajra [*Pennisetum typhoides*], oospores exposed to weathering since 1952 gave 4·4 per cent. infection in pots and 3·5 in the field. Oospore-infested soil, without the addition of extra inoculum, gave 1·5 per cent. infection.

The antibiotic action of *Bacillus subtilis* was not effective against bacteria, though seven out of 20 test fungi were inhibited.

Phytophthora infestans was cultured successfully in a liquid medium containing peptone and carrot extract. Complex nitrogen compounds such as amino acids were essential for its growth. *Lophotrichus ampulus* was heterotrophic for thiamine, and possibly for pyridoxine, while sporulation depended upon biotin and the presence of a carbohydrate source.

Commercial fungicidal seed dressings gave only a slight increase in yield to treated maize, but with *Pennisetum typhoides* there was also an increase in germination and tillering. In connexion with pre-emergence seed injury the soil microflora was shown to be more damaging than that of the seed, and eliminating the latter without giving a protective seed covering resulted in greater damage by the former.

The Indian isolates of *Pseudomonas solanacearum* differed from one another in chromogenesis, gelatine liquefaction, and the action on litmus milk, furnishing further evidence for the occurrence of distinct strains.

Mango trees in Delhi State have been affected by a severe leaf spot disease, causing irregular brown spots with raised purplish margins and dark pycnidial bodies on the dead central area. The causal agent is considered to be a new species, and is named *Macrophoma mangiferae* [without a Latin diagnosis]. It has dark-brown, globose pycnidia, 77 to 231 μ in diameter, and hyaline, oblong, single-celled, vacuolate pycnospores, 15·0 to 24·5 by 5·25 to 7·0 μ.

Morphological studies indicated that *Sclerotium rolfsii* and *Ozonium texanum* var. *parasiticum* were two distinct entities. They did not utilize carbohydrates very readily in culture. Oxalic acid was produced freely and caused similar injury to plants as chemically pure oxalic acid. Sclerotia immersed in water for three days or exposed to ammonia fumes lost their viability. Control measures including flooding, deep ploughing, and the use of ammonium fertilizers are suggested.

In the section on plant viruses [pp. 94–98] it is stated that in preliminary tests of tomato varieties and wild *Lycopersicon* species for resistance to [tobacco] leaf curl [virus] *L. peruvianum* gave low infection. At Poona the leaf curl disease was effectively controlled by spraying tomatoes with the insecticide ekatox. Tomato necrosis [a strain of potato virus X] was transmitted to *Nicotiana glutinosa* by grafting, but not by aphids.

Papaw mosaic virus is becoming more serious, but a search for natural cucurbitaceous hosts was unsuccessful. A leaf curl of papaw, very common in Delhi State, was transmitted by grafting and by white flies [? *Bemisia* sp.].

The American cotton variety L.S.S. was resistant to cotton small leaf disease, the insect vector of which has not yet been discovered.

Sap transmission of maize mosaic virus was successful to Sudan grass, *Euchlaena mexicana*, *Dactyloctenium aegyptiacum*, and *Coix lacryma-jobi*. Members of the Solanaceae, Cucurbitaceae, Umbelliferae, and Leguminosae were not infected.

Cardamom 'katte' disease [see preceding abstract] was shown to be present in a wild species of *Amomum* and to be transmitted by the aphid *Pentalonia nigronervosa*. The disease was effectively controlled by careful roguing.

A severe mosaic of sarson [Indian mustard] was observed in Simla. The virus nature of the phyllody disease of *Brassica campestris* var. *toria*, Indian mustard, and turnip has been established.

In cross-immunity tests there was no antagonism or cross-protection between *Dolichos* enation mosaic virus [30, p. 211] and tobacco mosaic virus in tobacco.

White fly [? *Bemisia* sp.] has been shown to carry pumpkin yellow vein mosaic virus and *Hibiscus esculentus* yellow vein mosaic virus simultaneously.

Annual Report, Cawthron Institute, Nelson, New Zealand, 1954-55.—48 pp., 1 pl., 1955.

In this report [cf. *R.A.M.*, 34, p. 214] it is stated (p. 16) that during the 1953–54 season a disorder of hop leaves leading to the breakdown of the lamina was found to be associated with a molybdenum content of only 0·02 p.p.m. In a field trial the use of sodium molybdate at 8 oz. per acre in a garden where the hop shoots were frequently rather yellow, with a subsequent white, interveinal spotting of the leaves, resulted in healthy leaves, containing three or four times more molybdenum than those affected. Ground limestone at 2 lb. per hill also improved growth and increased the molybdenum content of the leaves, but not to the same degree as the molybdate. These results suggest that the disorder is caused by molybdenum deficiency, believed to be a new record for hops.

The value of dolomite in the treatment of magnesium deficient soil was again strikingly demonstrated in the case of apple replants (p. 22). On untreated soils growth was poor and the foliage badly affected. Magnesite also gave some benefit, but this was less pronounced than with dolomite.

There were no new outbreaks of hop black root rot (*Phytophthora cactorum*) and the disease was less severe than in previous seasons (p. 33) [see next abstracts].

Both dithane and emulsified chlorobromopropene gave over 99 per cent. plants free from black root rot [*Thielaviopsis basicola*] in tobacco seed beds (p. 35); in the control plots 77 per cent. of the plants were heavily infected and 22 per cent. moderately so. In pot experiments the varieties Harrison's Special 523, TI 448A, and Amarello were the most resistant to *Verticillium* wilt [*V. albo-atrum*].

Twenty-ninth Annual Report of the Department of Scientific and Industrial Research, New Zealand, 1955.—76 pp., 1955.

In the section of this report [cf. *R.A.M.*, 34, p. 212] dealing with agricultural research (pp. 12–22) it was found by the Plant Diseases Division (p. 17) that streptomycin reduced peach blast [*Pseudomonas syringae*: 34, pp. 653, 795] infection from 91 to 2 per cent. in the greenhouse and from 70 to 15 per cent. in the field, reducing both the size and number of lesions. At a low concentration it also reduced pear blast infection from 46 to 25 per cent. under normal orchard conditions, when Bordeaux mixture had no effect.

Following the discovery that the use of hormones on tomato plants led to severe grey mould (*Botrytis cinerea*) infection, a co-operative investigation by the Plant Diseases Division and the Fruit Research Station demonstrated that a combined ferbam-hormone spray prevented mould attack without affecting fruit development.

Surveys by the Crop Research and Plant Diseases Divisions revealed that most of the common potato varieties are infected with one or more virus diseases, no disease-free plants of these varieties having been found.

The hop variety commercially grown at present is no longer generally acceptable owing to its susceptibility to *Phytophthora* [? *cactorum*: see preceding abstract] which is spreading rapidly through the gardens.

Copper deficiency, identified in tobacco crops [34, p. 214] on three distinct soil types, is characterized by failure to ripen accompanied by a chestnut brown breakdown of the leaf. Control consists of applying 40 lb. copper sulphate per acre before planting.

E. J. Godley outlines the work planned by the Crop Research Division (pp. 41–43) and G. H. Cunningham that of the Plant Diseases Division (pp. 57–64).

Overseas news.—*Commonw. phytopath. News*, 1, 4, pp. 57–62, 1955.

In South African notes contributed by J. E. Van der Plank (pp. 59-60) citrus concentric ring blotch [*R.A.M.*, 34, p. 523] is ascribed to a toxin released from the eggs of an undescribed four-legged mite. Much of the tomato crop was destroyed by late blight (*P[hytophthora] infestans*) [34, p. 824; 35, p. 162] which reappeared on this host in 1951, the first time for 28 years, and since then has remained the most important disease of the crop. This experience is similar to that in the United States where *P. infestans* flared up on tomato in 1946.

H. C. Smith (p. 60) described methods for testing resistance to *Phytophthora* species in various crops devised in New Zealand. In testing apples for susceptibility to collar rot, small pieces of an agar culture of *P. cactorum* were inserted under the bark and the resulting lesion measured a month later. For investigating resistance to apple crown rot, caused by the same fungus, and black root rot of hops (*P. c.* var. *applanata*) small pieces of root were surface-sterilized, a slice removed from one end, and the cut surface placed on an agar culture of the pathogen. The extent of rot was measured after six days' incubation at 25° C. In testing cacao against *P. palmivora*, detached pods or shoots were inoculated (the shoots on the freshly cut surfaces at each end) with a sporangial suspension and wrapped in plastic bags for six days prior to the measurement of infection. Results from these techniques gave consistent varietal differences.

From India, R. S. Vasudeva (p. 61) reported that the agent of the bacterial leaf spot of pomegranate [33, p. 98, and above, p. 279] has been named *Xanthomonas punicae*. The disease is favoured by high temperatures and low humidity and is carried over in dried, fallen leaves.

Valdeyron (G.). **Rapport sur les travaux de recherche effectués en 1953.** [Report on the research work carried out in 1953.]—*Ann. Serv. bot. Tunis*, 25 (*1952*), *Suppl.*, 34 pp., [1954. Received 1955.]

In this report [cf. *R.A.M.*, 34, pp. 140, 285] it is stated that histological examination of samples of 2,601 q. of wheat treated against smut [*Ustilago tritici*: loc. cit.] by the continuous method showed that 247 of the 6,242 grains were still infected. Untreated pedigree seed of Ariana 8 (3,000 q.) was completely healthy. As treatment is very costly it is hoped that in future more reliance may be placed on the production of uninfected seed.

An attack of vine [downy] mildew [*Plasmopara viticola*: 35, p. 76] of exceptional virulence did not prevent the hybrid Beldi × Ugni blanc 36 1 4 from giving a good yield, whereas many test lines produced poorly. Of the varieties in the collection at the College of Agriculture, Saturn, Aligoté, Chenin blanc, Grapello bianco, Perephinao portalegre, Vin Nosello, Gros vert, and Perloccia were highly resistant and 34 varieties were classed as resistant. The plant pathology section (pp. 24–27) refers to the work of the cryptogamic laboratory of the Botanical and Agronomical Service on selection and seed production. Among 122 lines tested, soft wheat derived from Thatcher and the hard wheat M'Rari as well as the American varieties of this species maintained their resistance to black rust [*Puccinia graminis*: 34, p. 285].

The removal by hand of wheat ears infected by smut is useful when dealing with small quantities of seed for experiments, but not otherwise. Work on the disinfection of cereal seed against smuts by dusting continued, steeping having been

abandoned. The organo-mercurials tested behaved as previously. Hexachlorobenzene, which remains a standard product against wheat bunt [*Tilletia ?foetida*: loc. cit.], was effective in concentrations from 4 to 5 per cent. upwards.

Thirty-fourth Annual Report, Department of Agriculture, California, for the period ending 31 December, 1953. Bureaux of Plant Quarantine and Plant Pathology. —*Bull. Dep. Agric. Calif.*, 42, 4, pp. 234–252, 2 figs.; 253–272, 2 figs., 1954.

In the Plant Quarantine Section of this report [cf. *R.A.M.*, 34, p. 85] A. P. Messenger deals with external quarantine of plant material entering the State and internal quarantine covering inspection of such material at inland delivery points and also at nurseries. The Elm Tree Diseases Exterior Quarantine has been amended as from 13th January, 1953, to include Maine, where Dutch elm disease [*Ceratostomella ulmi*: 34, p. 683] has been found, and adding *Zelkova* and *Planera* plants to the list of hosts and possible carriers. As these latter are not susceptible to phloem necrosis [32, p. 156], which is covered by the same quarantine, amendments have been made accordingly.

The Oak Wilt [*Chalara quercina*: 34, p. 686] Disease Exterior Quarantine has been amended as from 16th April, 1953, adding species of chestnut, chinquapin [*Castanea pumila*], and tanbark oak (*Lithocarpus densiflorus*) to the list of hosts and possible carriers.

The Quick Decline [34, p. 85] Interior Quarantine was amended as from 22nd April, 1953, revising quarantine lines and the regulations concerning movement of restricted articles.

In 1953al together 11,298 ship inspections were made., 3570 of which revealed prohibited material. Airplane inspections were carried out on a total of 2,553 arrivals, 35 from Hawaii having no prohibited materials, and 2.518 from foreign countries, 422 carrying prohibited material. Under permit 2,169 shipments entered; 131,494 packages were treated before release and 16,795 items of restricted or prohibited material were rejected. Insects or diseases were intercepted in 18,358 cases, including 94 of citrus canker [*Xanthomonas citri*].

There has been added emphasis on pest control in nurseries and search for new pests or for those of limited distribution in California. Red stele [red core] (*Phytophthora fragariae*) [34, p. 305] was first recorded in the early spring of 1953 in 11 growing grounds. Symptoms were obscure in the summer and even in infected areas only appeared after the December rains. Shipping of plants from such areas was prohibited. Some 12,000,000 Californian certified strawberry plants were marketed in 1953, as against 2,000,000 in 1952.

Roses were affected by crown gall [*Agrobacterium tumefaciens*: 30, p. 370] and hairy root disease [*A. rhizogenes*: 25, p. 292], up to 25 per cent. on certain fields.

Citrus trees registered as inspected and found free from psorosis [35, p. 179] now total 876, including 614 Valencia, 103 Washington navel, 54 seedling sweet orange, 6 Marsh seedless grapefruit, 70 Eureka, 11 Lisbon, one Villafranca, four Rafferty, two Frost nucellar, and 11 seedling lemon.

In the Plant Pathology Section of this report [cf. 34, p. 84] G. L. Stout states that azalea [*Rhododendron*] flower spot (*Ovulinia azaleae*) [cf. 35, p. 190] has been brought under control by sanitary practices. In 1953 it was only found in a limited degree on three properties. It has not been observed on wild plants. Field inspections in autumn and early winter, 1953, of 363 cotton plantings, of which 108 were overhead-irrigated and 255 furrow-irrigated, showed the presence of angular leaf spot or bacterial blight (*Xanthomonas malvacearum*) [33, p. 537] in 15 fields in Fresno County, six in Kern, one in Madera, and two in Tulare, all overhead-sprinkled. It is assumed that the causal bacteria are present in certain seed sources but are usually kept in check by the dry heat prevailing during the growing season, while

rain and overhead watering favour development. Infection was mostly light and localized in a field.

A. M. French reports that in 1953 1,048 peach trees were found to be affected by peach mosaic virus, 63 properties being infected for the first time. No infection occurred in nursery stock. Altogether the number of infected trees has been reduced by 47 per cent. since 1952 and that of infected properties by 34.

R. L. McClain reports that in 1953 inspections of about 92,000 acres of oranges in 22 counties revealed the presence of quick decline in the counties of Los Angeles, Orange, Riverside, San Bernardino, and Ventura; there was no recurrence in San Diego. In the lightly affected areas the disease continues to make slow but steady progress, except in Ventura, where it maintains a high incidence. In heavily infected areas numerous orchards were closed, and quarantine lines extended as from 22nd April, 1953. It was estimated that by 31st December, 1953, about 87 per cent. of the State's acreage planted to oranges were in the quarantine area and that 99 per cent. of all infected trees were or had been in the heavily infected parts, which constituted 42·2 per cent. of the total orange acreage.

The number of individual orange trees affected by quick decline to date is less than 3 per cent. of the total.

A. Schlocker states that in 1953 some 3,734,228 peach and nectarine trees on 1,962 properties in 13 counties were inspected for yellow leaf roll; 463 new cases were found on 167 properties (all in the 'peach bowl' area). 155 on 105 properties having no previous record of the disease. All diseased trees (only 46 per cent. of the number found in 1952) were destroyed.

Thirty-fifth Annual Report, Department of Agriculture, California, for the period ending 31 December, 1954. Bureaux of Plant Quarantine and Plant Pathology. —*Bull. Dep. Agric. Calif.*, 43, 4, pp. 197–208; 209–228, 1 fig., 1955.

The work of the Bureau of Plant Quarantine [cf. preceding abstract] for the year 1954 is reported by A. P. Messenger.

G. L. Stout presents the report of the Bureau of Plant Pathology in which G. E. Altstatt, C. W. Nichols, and R. M. Nakayama state that internal cork virus was found in sweet potato [*R.A.M.*, 34, p. 84] in field and storage during 1953 in the San Joaquin Valley; in January and February, 1954, it appeared for the first time in stored sweet potatoes in Orange and Riverside Counties. Almond scab (*Cladosporium* sp.) causing small, olive to black lesions, was responsible for losses in several orchards. The causal fungus may be *C.* [*Fusicladium*] *carpophilum*, but other stone fruits near by were not affected. Broccoli bacterial spot (*Pseudomonas maculicola*) [33, p. 396] occurred in San Louis Obispo and Orange Counties; floret infection, found in the field only in humid conditions, may develop in transit.

Dead arm of grapes (*Cryptosporella viticola*) [30, p. 557] appeared for the first time in the San Joaquin Valley south of Lodi.

R. L. McClain reports that quick decline of citrus continued its slow progress in the lightly infected areas of Orange and Los Angeles Counties and San Bernardino; several infected properties in the Bryn Mawr district showed a steep increase; first records of diseased trees were made in Riverside County. In parts of the Sta. Clara Valley, Ventura County, quick decline was found over almost the whole citrus growing area. On oranges the disease was found only on two Satsuma trees in Butte County. Meyer lemon trees inside and outside the quarantine areas were generally infected, even when not showing symptoms.

A. Schlocker states that 122 new cases of peach yellow leaf roll found on 40 properties in Butte, Sutter, and Yuba Counties were destroyed. There was for the first time a decrease in the number of tree cases and infected properties, the latter falling from 105 in 1953 to only 16 in 1954. Annual inspections since 1936 have failed to discover yellow leaf roll south of the Tehachapi Mountains.

New cases (589) of western X-disease of peach [34. p. 463] were found on 226 properties in all counties except Contra Costa and El Dorado. A significant reservoir of this virus developed in northern and central California before inspections began in 1950. Diagnosis by visible symptoms alone is difficult, since infected trees do not always show definite symptoms; visible injury may be indistinguishable from that caused by other factors, and especially in old orchards many trees have sunburn in scaffold branches, wood decay, and limb breakage.

According to A. Schlocker, and R. L. McClain, 48 new cases of peach yellow bud mosaic were found in San Bernardino County, three of which were on two newly infected properties. In Placer County there were 323 new cases, 39 on five properties not previously known to be affected. No infection was found in nurseries or their immediate surroundings. In Yuba County about 54,459 trees on 15 properties, that is about 15 per cent. of the whole peach and nectarine acreage, were inspected, and in El Dorado County 8,556 trees on 31 properties: only eight cases were found in one small orchard near Placerville.

H. K. Wagnon reports that ring spot [34. p. 378] and rugose mosaic [cf. 30. p. 278] occurred in young commercial cherry plantings of trees grown from sources thought to be virus-free, which stresses the need for complete isolation of budwood sources from commercial plantings. Peach and nectarine trees known to be affected by an as yet unidentified disease, with leaf symptoms suggestive of both yellow leaf roll and western X-disease, were rejected as budwood sources. Other peach and nectarine diseases found included the virus disorder tentatively known as 'peach stunt' found in 49 trees on nine properties, and which in one nursery affected a high percentage of autumn-budded yearling trees of one variety.

Almond diseases included almond calico, ring spot [? peach ring spot virus: 30. p. 277], and Drake almond bud failure. An unnamed disorder characterized by chlorotic and malformed leaves, possibly virus-caused, was found on four trees of the Jordanolo variety on one property.

Among plums and prunes, the most prevalent virus disease was line pattern [peach line-pattern virosis virus: 32. p. 234]; the high incidence of this mild virus is thought to be due to contamination of cutting-grown rootstocks. Prune diamond canker, a virus disease so far seen only on the French (Agen) prune, was found on 70 trees on six properties in two counties. In 1953 and 1954 chlorotic feather-edged blotches or clearings between or along the veins and veinlets were found on 15 Wickson trees on one property: inoculations made in 1953 from one of these trees produced more striking leaf symptoms on two Bormosa trees during 1954.

T. R. Carpenter surveying vine diseases, reports that the condition hitherto known as 'unfruitful vines' [34. p. 345] has now been named 'yellow vein' and has been proved transmissible. The symptoms include straggly bunches with shot berries or none, mottling, speckling, and vein-yellowing on the lower leaves. Yellow vein occurred in 16 counties, on 176 of 2,591 plantings, and in 8,152 vines of 47 varieties: it seriously inhibited the production of grapes.

The same author reports that southern blight (*Sclerotium rolfsii*) was found on a commercial planting of gladiolus in 1953.

Bhatt (V. V.) & Patel (M. K.). **Comparative study of species of Xanthomonas parasitizing leguminous plants in India.**—*Indian Phytopath.*, 7 (*1954*), 2, pp. 160–180, 1955.

A cultural study of 12 species of *Xanthomonas* [*R.A.M.*, 32. p. 238] parasitizing legumes in Bombay State was made at the College of Agriculture, Poona, on neutral media at 30° C. All the species were Gram-negative, capsulated rods, motile by a single polar flagellum, growing well in potato dextrose and nutrient dextrose agars and liquefying gelatin, hydrolysing starch, digesting casein, producing hydrogen

sulphide and ammonia from peptone but no indole or nitrate, forming acid in mono-, di-, and polysaccharides and alkali in acetic, citric, and lactic acids, and utilizing all ammonium compounds, but not nitrates of heavy metals, and amino acids (in the presence of dextrose). All tolerated sodium chloride up to 3 per cent., were inhibited slightly by 1 in 1,000 crystal violet, and completely by 1 in 3,333 malachite green and 1 in 6,666 potassium dichromate. Only *X. alfalfae*, *X. cassiae*, *X. cyamopsidis*, *X. sesbaniae*, and *X. cajani* utilized nitrogen from potassium and sodium nitrates but they did not produce ammonia or nitrite.

Garden pea was the common host of *X. alfalfae* and *X. cassiae* and runner bean (*Phaseolus vulgaris*) of *X. vignicola* and *X. phaseoli-sojense*. *X. alfalfae* infected *Melilotus indica* and *Trigonella foenum-graecum*, *X. vignicola Vigna sinensis*, *X. phaseoli-sojense Dolichus biflorus* and *P. lunatus*, and *X. tamarindi Caesalpinia sepiaria*. A key for differentiating the species is given. The authors consider that the suggested accommodation of the phytopathogenic bacteria in a new family Phytobacteriaceae [32. p. 11] deserves serious consideration, and recommends that host specificity be accepted as the only reliable character for establishing a new species.

Patel (M. K.), Kulkarni (Y. S.), & Dhande (G. W.). **Some new bacterial diseases of plants.**—*Indian Phytopath.*, 7 (*1954*), 2, pp. 103–110, 2 figs., 1955.

The information in this paper on three bacterial diseases in India has already been noticed from a shorter version [*R.A.M.*, 32, p. 368].

Manil (P.) & Fourneau (J.). **Action du thiouracile et de l'uracile sur le crown-gall.** [The action of thiouracil and of uracil upon crown gall.]—*Bull. Inst. agron. Gembloux*, **23**, 1, pp. 55–65, 2 figs., 1955.

While thiouracil was shown to have no lethal effect upon *Agrobacterium tumefaciens in vitro* it inhibited the development of crown galls on *Datura* and tomato plants and reduced the size of galls already formed. Uracil, applied previously or simultaneously, counteracted the effect of thiouracil and when used alone appeared to stimulate gall formation. Certain analogies between these results and the effect of the compounds on virus multiplication [*R.A.M.*, 33, p. 702] are pointed out.

Smith (H. C.) & Savea (S. P.). **Control of black pod disease of Cocoa.**—*Bull. Dep. Agric. W. Samoa* 1, 5 pp., 1 fig., 2 diags., 1955.

During 1953 losses from black pod disease (*Phytophthora palmivora*) were estimated at one-quarter of the cacao crop on well-managed plantations in western Samoa [*R.A.M.*, 35, p. 170] and at least one-half on the others. This popular bulletin recommends control measures for local conditions. Two bucket spray pumps are sufficient for applying Bordeaux mixture to small plantations while experiments during 1955 demonstrated the efficiency of portable mist blower machines at £130 each for larger ones. The 1955 prices in Apia were 8*d*. per lb. for copper sulphate and 2*d*. for slaked lime and half a drum of spray cost 1*s*. 8*d*. and sufficed for about 40 trees. Therefore spraying cost about ½*d*. per tree and was not profitable unless the crop exceeded 10 pods per tree and more than one pod in five was attacked. The main cropping season for cacao in western Samoa, between October and January, is also the wettest and therefore the period when spraying gives the greatest returns.

Urquhart (D. H.). **Cocoa.** —xix + 230 pp., 56 pl. (8 col.), 4 figs., 5 diags., 7 graphs, 3 maps. Longmans, Green and Co. Ltd., London, 1955. 35*s*.

The value of this very well-illustrated book is enhanced by contributions on certain matters from well-known authorities. It will doubtless become a standard text-book, covering as it does all aspects of cacao production from the field to the

market. In the chapter on pests and diseases a good general account is given of each of the latter and a separate chapter by A. F. Posnette deals with the virus diseases of the crop. Useful reference lists are appended to each chapter.

Shoemaker (R. A.). **Biology, cytology, and taxonomy of Cochliobolus sativus.**—*Canad. J. Bot.*, 33. 6, pp. 562–576, 3 pl., 1955.

At Cornell University, Ithaca, New York, mature ascocarps of *Cochliobolus sativus* [*R.A.M.*, 32, p. 178] were produced on boiled, surface-sterilized maize seeds partially immersed on Snell's agar. Mono-ascospore cultures and isolates from the conidial state *Helminthosporium sativum* syn. *H. sativum*, were hermaphroditic but heterothallic [loc. cit.]. Descriptions are given of the production and features of spermatia and ascogonia, and the formation of mature asci from compatible crosses. From a study of the liberation of the asci the genus *Cochliobolus* is placed in the Pseudosphaeraceae in the order Pseudosphaeriales.

Johnston (C. O.) & Lambe (M. N.). **Fifth revision of the international register of physiologic races of Puccinia rubigo-vera (D. C.) Wint. f. sp. tritici (Erikss.) Carleton = (P. triticina Erikss.).**—*Plant Dis. Reptr.*, Suppl. 235, pp. 104–120, 1955. [Multilithed.]

This revision of the international register of physiologic races of leaf rust (*Puccinia rubigo-vera*) of wheat [cf. *R.A.M.*, 34, p. 219] adds another 91 races, described since the publication of the fourth revision (*U.S. Dep. Agric. Bur. Pl. Industr., Soils, agric. Engng* [1951], 4 [1951]), bringing the total to 163. A tabulated summary shows the author and year of publication of all races described to date. Race 93 is considered as a sub-race of race 24, and races 96 and 97 as sub-races of race 68.

Young (H. C.) & Wanderwerth (D. F.). **Experimental forecast of Wheat leaf rust for Oklahoma for 1955.**—*Plant Dis. Reptr.*, 39. 5, p. 438, 1955. [Multilithed.]

Wheat leaf rust (*Puccinia rubigo-vera* var. *tritici* [*P. triticina*]) was expected to cause a loss of 1 to 2 per cent. in Oklahoma in 1955 [cf. *R.A.M.*, 33, p. 715]. The forecast was based on the amount of inoculum present on 1st April, determined from the number of rust pustules on 1,000 tillers of the susceptible Cheyenne variety at Stillwater supplemented by a survey of the rust situation throughout the State at the end of March.

Antonini (P.). **L'efficacia anticarie di nuovi prodotti acuprici in una prova in Campagna.** [The anti-burnt efficacy of new non-copper products in a test in Campania.]—*Atti Soc. agr.*, N.S., 3. 6, pp. 1767–1773, 1954. [English summary.]

In an experiment carried out at the Institute of Plant Pathology, Padua, in November 1952, Terrere wheat seed artificially inoculated with the chlamydospores of *Tilletia levis* [*T. foetida*] and treated with various non-copper products, as well as with copper oxychloride in the form of Caffaro powder [*R.A.M.*, 7, p. 526] for comparative purposes was sown in a field in the Campania. The treatments were: (1) healthy, untreated seed, (2) infected, untreated seed, (3) infected, treated with Caffaro powder, (4) with seban [34, p. 424], (5) with S 23 [33, p. 329], (6) with FB 1 [loc. cit.], (7) with TF, (8) with mercurigamma [34, p. 424], (9) with agrosan GN; and (10) with pentagran. The dosages used were those recommended by the manufacturers.

The results given by the different treatments (four replications each) expressed as percentages of harvested ears found to be bunted were, respectively, 0; 48·77 to 50·26; 19·61 to 20·13; 11·67 to 13·32; 0 to 0·68; 0 to 0·25; 50·32 to 52·12; 0 to 0·35; 0·52 to 1·83; and 0 to 0·63.

Fushtey (S. G.). **The control of dwarf bunt of winter Wheat with chemical seed treatments.**—*Plant Dis. Reptr.* 39. 5. pp. 378–379. 1955. [Multilithed.]

At the Department of Botany, Ontario Agricultural College, Guelph, Canada, wheat seed inoculated with spores of dwarf bunt (*Tilletia brevifaciens*) [*T. controversa*: *R.A.M.*, 35. p. 8] was treated with fungicides and stored in flasks for eight days. Spore suspensions prepared from the seed at intervals were incubated with soil and the mixtures examined microscopically for spore germination, indicated by the presence of sporidia. Tritisan, anticarie (both at ½ and 1 oz. per bush.), and panogen (¾ and 1½) completely prevented germination during the ten-week incubation period.

Larter (E. N.). **The use of ionizing radiations in the possible utilization of an Agropyron source of bunt resistance.**—*Diss. Abstr.*, 15. 5. pp. 864–865. 1955.

In work at the State College of Washington ionizing irradiations were employed in an attempt to transfer genes for resistance to bunt (*Tilletia* sp.) from a 56-chromosome wheat-*Agropyron* derivative to a hexaploid wheat. X_2 seed was artificially inoculated with bunt races T–13 and T–16 and was sown during autumn at Pullman, Washington, and Pendleton, Oregon. The lowest dose of X-ray used (10,000 r-units) appeared to be the most effective.

Although the chromosome numbers of disease-free X_2 plants ranged from $2r = 42$ to $2r = 56$, their distribution was sharply skewed in the direction of the higher chromosome classes. In spite of the selective elimination of gametes with the higher chromosome numbers, genetic stability and resistance to bunt were retained at the lower chromosome levels. The occurrence of bunt-free X_2 plants with chromosome numbers as low as 42, 43, and 44 suggested that few *Agropyron* chromosomes conditioned resistance to bunt. Because of this possibility, a monosomic breeding technique was begun in an attempt to obtain hexaploid progeny containing the *Agropyron* resistance.

While disease-free, nearly hexaploid ($2r = 42$) plants were obtained in the X_2 and BC_2 populations, data from more advanced segregating generations are required before a final appraisal can be made of the results of the present work.

Zscheile (F. P.). **Attempt to increase bunt expression in Wheat by unusual inoculation methods.**—*Phytopathology*, 45. 9. pp. 480–484. 1955.

At the Department of Agronomy, University of Davis, California, unusual methods of inoculation, based on those of Rabien [*R.A.M.*, 7, p. 83], were used in attempts to secure a large proportion of plants showing bunt (*Tilletia caries*) symptoms in the susceptible Baart variety [35. p. 7]. Seeds were germinated in contact with various kinds of inoculum at low temperatures (ranging from 4° to 16° C.) and soaked or treated with nutrients known to stimulate the growth of the fungus in culture.

Bunt developed in plants from seedlings inoculated with mycelium and its expression was promoted by prolonged contact of the seed with germinated chlamydospores, resulting in 89 per cent. infection in the greenhouse. Immersion of inoculated seeds in 0·01 per cent. thiamine solution also incited the appearance of symptoms. The injection of germinated seeds with germinated chlamydospores, but not with mycelium, was similarly effective. Injections into the leaf whorls of young seedlings were most efficient when the chlamydospores were suspended in MT1 nutrient medium [31. p. 322]. Field plants were inoculated at various stages of growth from early seedling to soft dough. Two out of 10 plants injected with chlamydospores above the apical node at late tillering produced one bunted kernel each. The injection of chlamydospores into the flowers of five plants resulted in the production by three flowers of seeds containing small chlamydospore sori [cf. 10. p. 17; 19. p. 525]. No symptoms were observed on plants of the resistant Baart 38

or Baart 46 varieties grown from seed or seedlings inoculated by these methods, which are not considered to be promising for field experiments under local conditions.

OHMS (R. E.) & BEVER (W. M.). **Types of seedling reaction of Kawvale and Wabash winter Wheat to three physiologic races of Ustilago tritici.**—*Phytopathology*, 45, 9, pp. 513–516, 2 figs., 1955.

At the Illinois Agricultural Experiment Station flowers of two winter wheat varieties, Kawvale and Wabash, were inoculated by the hypodermic-needle method with physiologic races 1, 3, and 11 of *Ustilago tritici* [*R.A.M.*, 27, p. 227 and next abstract]. The former variety has been found resistant to all three races [33, p. 473] and the latter to race 11 only. The percentages of embryo, scutellum, and growing point infection induced in Wabash by race 1 were 54·3, 48, and 48, respectively, by race 3, 35·4, 31, and 31, and by race 11, 76·9, 5, and 5, respectively. The corresponding figures for Kawvale and race 1 were 48·9, 40·8, and 0; race 3, 59·2, 52·4, and 2·4; and race 11, 74·5, 75·5, and 2·4. A fortnight after sowing the third internodes of infected Wabash seedlings showed reduced elongation with no fourth-node elongation, whereas in Kawvale the fourth internode was elongated and the third shortened. A week later the fourth and fifth internodes of both varieties were abnormally elongated.

Resistance in Kawvale seedlings was expressed before the third foliage-leaf stage was reached. In this type of resistance the scutella developed infection, but not the growing points. Resistance appeared to be correlated with the ability of the seedling to outgrow the invading pathogen.

The low percentage of smutted heads in Wabash inoculated with race 11 is attributed to hypersensitivity in the seedling stage [35, p. 88]. Seedlings with growing-point infection either failed to emerge or died between the third and fifth foliage-leaf stages. The inoculation of Wabash seedlings with *U. tritici* enhanced their susceptibility to infection by [unspecified] soil organisms.

OHMS (R. E.). **Pathological and morphological effects of Ustilago tritici (Pers.) Rostr. on winter Wheat.**—*Diss. Abstr.*, 15, 5, pp. 681–682, 1955.

In studies at the University of Illinois winter wheat became infected by *Ustilago tritici* [see preceding abstract] during flowering after fertilization. The chlamydospores on the pistils germinated before pollination and also invaded the anthers, but no penetration of the pistil was noted until after fertilization. After passing through the micropyle the hyphae changed from a non-branched, thread-like, intercellular growth to a branched, much thickened, knobby type that grew both intra- and intercellularly. The same path was taken in resistant and susceptible varieties, and no difference was noted in the frequency of embryo infection.

Resistance was of two types: over-susceptibility (Wabash to race 11) and the Kawvale type. In the over-susceptible reaction the seedlings failed to emerge or died in the third to the fifth foliar leaf stage. There was some evidence that death was due to interaction between [unspecified] soil organisms and the smut hyphae.

PICHLER (F.). **Bekämpft den Flugbrand!** [Control loose smut!]—*Pflanzenarzt*, 8, 3, pp. 18–20, 1 fig., 1955.

Loose smuts of wheat and barley [*Ustilago tritici* and *U. nuda*] still cause considerable damage in Austria [*R.A.M.*, 33, p. 343]. The recommended treatment [loc. cit.] of soaking in water at 30° C. for four hours, followed by a water bath at 52° for 10 minutes, is suited only for establishments with the necessary equipment. On a smaller scale the following methods proved adequate for barley. In the first a wooden vat is filled with water, or preferably a 0·01 per cent. disinfectant solution, at approximately 60° and the grain in loosely filled sacks is dipped repeatedly

and then left in the liquid for two hours, the temperature being maintained at 45°. Subsequently the grain should be left moist for 24 hours, but the swelling makes drying a lengthy process. As an alternative, the grain with 17 to 18 l. of water for every 100 kg. of grain is placed in a tightly closed drum, rotated in a water bath at 46° for three hours. It is then possible to dry the seed fairly quickly owing to the small volume of water used. For wheat the water temperature should be 47° to 48° and the period of immersion two to three hours.

Varieties with very low infection in 1953 following artificial inoculation were the winter wheats Admonter früh, Kornenberger, and Lassers Dickkopf, and Tschermaks Marchfelder and Otterbacher summer barley.

DUFF (A. D. S.) & GILMOUR (J. A.). **The treatment of loose smut of Barley in Kenya.**—*E. Afr. agric. J.*, 20, 4, pp. 225–227, 1955.

In a field test carried out in Kenya for the control of loose smut (*Ustilago nuda*) on Glacier barley, hot-water treatment [cf. *R.A.M.*, 34, p. 139] (pre-soaking in cold water for four hours followed by five minutes at 121° F., then ten at 127°, the grain being spread out in thin layers to dry) gave 95 per cent. germination, as against 97 per cent. for the untreated. After soaking in 0·2 per cent. spergon for 48 hours and then drying, germination was 47 per cent. At harvest both treated lots yielded 8½ bags per acre and at the end of the heading period total smut was 2·44 per cent. for the spergon treatment and 0·56 per cent. for the hot-water.

In spite of the loss in germinative capacity and the higher incidence of infection, spergon offers the simpler means of reducing smut in a crop to within economic limits. The poorer initial stand was compensated for by extra tillering.

LAST (F. T.). **Seasonal incidence of Sporobolomyces on cereal leaves.**—*Trans. Brit. mycol. Soc.*, 38, 3, pp. 221–239, 1 diag., 6 graphs, 1955.

At Rothamsted Experimental Station the numbers of *Sporobolomyces* colonies [cf. *R.A.M.*, 12, p. 777] developing on leaves of winter- and spring-sown wheat and spring-sown barley were estimated by sampling at 14-day intervals, using a technique in which the leaf blades were stretched over potato dextrose agar in a Petri dish and the resultant colonies counted. As the crops became dense the changes in *Sporobolomyces* numbers (which appeared to be mainly *S. roseus*) were similar in all three: the leaves bore few colonies until they were half-grown, after which the numbers increased progressively, reaching a maximum after the leaves had died. While the crops were still sparse, winter-sown wheat also produced colonies on living leaves, but at this stage they occurred only on dead leaves of spring-sown wheat and barley. Dead leaves in summer bore three times as many colonies per unit area as those in winter. The upper and lower surfaces of ageing leaves carried an equal number of colonies, but the distal parts more than the proximal. Colony numbers appeared to be correlated with high humidity and possibly with exudations from ageing leaves. *Sporobolomyces* did not in any way influence leaf parasites, but the presence of *Tilletiopsis*, identified as *T. minor* and also innocuous, in July and August, markedly decreased the number of *Sporobolomyces* colonies, particularly on the spring-sown barley. *Cladosporium* was also isolated regularly from dead leaves, particularly in summer, and occasionally also *Bullera alba*. It is suggested that leaves have a 'phyllosphere' with a characteristic flora, analogous to root rhizospheres.

HOOKER (A. L.). **Corn diseases in Iowa nurseries in 1953 and 1954.**—*Plant Dis. Reptr*, 39, 5, pp. 381–383, 1955. [Multilithed.]

Maize nurseries were established at the Iowa Agricultural Experiment Station, Ames, in 1953 and 1954 for the simultaneous evaluation of resistance to several diseases. With *Helminthosporium turcicum* and *Puccinia sorghi* the methods of

evaluation were the same as in previous trials [*R.A.M.*, 33, p. 533]. There appeared to be two types of rust resistance, protoplasmic, expressed at all stages, and that expressed by mature plants in the field. Resistance to *Diplodia zeae* [34, p. 364] was assessed by injecting a spore suspension into the stalk after pollination and by noting the spread of the pathogen in stalks cut longitudinally at harvest. Crazy top (*Sclerospora macrospora*) affected some plants following flooding in the seedling stage [32, p. 554]. The value of such nurseries in maize breeding programmes is emphasized.

Boewe (G. H.). **Stewart's disease prospects for 1955 in Illinois.**—*Plant Dis. Reptr*, 39, 5, pp. 384–385, 1 map, 1955. [Multilithed.]

According to the annual forecast made by the Illinois State Natural History Survey, Urbana, bacterial wilt (*Bacterium* [*Xanthomonas*] *stewarti*) of maize [*R.A.M.*, 34, p. 32] in 1955 was expected to be less destructive and to extend less far north in the State than in 1953 and 1954. The bacterium overwinters chiefly in the bodies of adult maize flea-beetles [*Chaetocnema pulicaria*: 27, p. 70 and next abstract] which have been successfully controlled by soil applications of 1¼ to 1½ lb. dieldrin per acre before planting or by foliage sprays (1¼ lb.) when the beetles first appear.

Natti (J. J.). **Control of Stewart's bacterial wilt of Corn by foliar application of streptomycin sprays.**—*Plant Dis. Reptr*, 39, 5, pp. 386–390, 1955. [Multilithed.]

At the Department of Plant Pathology, New York State Agricultural Experiment Station, Geneva, growth of *Bacterium* [*Xanthomonas*] *stewarti* from maize [see preceding abstract] was inhibited in filter disk tests by streptomycin sulphate and agrimycin containing 100, 50, and 25 p.p.m. active streptomycin, and in broth dilution tests by agrimycin containing 500 to 3·9 p.p.m. In trials in 1954 on plots of maize with 8, 12, and 19 per cent. natural infection none of the five different streptomycin preparations, applied once or twice to the foliage, proved of therapeutic value, suggesting that the amount of streptomycin supplied (100 p.p.m.) was insufficient to provide an effective concentration within the plants. However, the increase in disease incidence 18 to 25 days later averaged only 7 to 11 per cent. as against 19 per cent. for the unsprayed. This may be attributed to the inactivation of some of the wilt bacteria in exposed flea-beetle (*Chaetocnema pulicaria*) lesions and on the mouth parts and within the bodies of the beetles before infections were initiated.

Viets (F. G.), Boawn (J. C.), Crawford (C. L.), & Nelson (C. E.). **Zinc deficiency in Corn in central Washington.**—*Agron. J.*, 45, 11, pp. 559–565, 1953.

In further studies on zinc deficiency of maize in irrigated soils in central Washington [*R.A.M.*, 31, p. 141], the zinc contents of the tops of plants (cut off at ground-level) showing moderate deficiency symptoms and of normal plants at three stages of growth were about equal, but there was an excessive accumulation of potassium and phosphate in the former consequent on arrested development. At each sampling date (22nd June, 6th July, and 21st July) normal plants were much larger and the roots richer in total zinc. In field experiments yields were not increased, though vegetative growth was stimulated, by applications of zinc sulphate as a spray or soil amendment for the control of moderate or severe zinc deficiency. A zinc content of 15 p.p.m. in the leaf from the second node below the ear at silking was found to be an adequate level for the production of 100 to 125 bush. per acre. The content of extractable zinc in the affected soils was very low (maximum of 0·4 p.p.m.).

W[iltshire] (S. P.). **The spread of the South American Maize rust.**—*Commonw. phytopath. News*, 1, 4, p. 62, 1955.

Maize rust (*Puccinia polysora*) has invaded almost the whole of Africa south of

the Sahara [*R.A.M.*, 35, p. 81] and has now been recorded from Agalega Island, 500 miles north of Mauritius [34, p. 780], constituting a threat to crops in India, Pakistan, and Ceylon.

Brusca (J. N.) & Haas (A. R. C.). **Zinc effect in Citrus and Avocado.**—*Calif. Citrogr.*, 40, 10, pp. 384–385, 2 figs., 1955.

At the University of California Citrus Experiment Station [Riverside] zinc at concentrations from 0·4 to 1 p.p.m., added as sulphate in a nutrient solution to Prior Lisbon lemon cuttings in sand cultures, corrected leaf mottle caused by zinc deficiency [*R.A.M.*, 34, p. 718 and preceding abstract], and increased leaf size, improved colour, and stimulated growth. Similar results were obtained with Nabal avocados in soil cultures supplied with zinc at 5 to 15 p.p.m. [cf. 20, p. 267].

Klotz (L. J.) & De Wolfe (T. A.). **Control of Septoria spotting.**—*Calif. Citrogr.*, 40, 10, p. 396, 3 figs., 1955.

Zinc-copper-lime sprays in early autumn are recommended against *Septoria* spotting of citrus [*R.A.M.*, 22, p. 131; 34, p. 641] in the Central Valley, California. They also correct copper and zinc deficiencies [see preceding abstract]. An application of 1:2:100 Bordeaux should be made early in February.

Ford (H. W.). **Root distribution of chlorotic and iron-chelate-treated Citrus trees.**—*Proc. Fla hort. Soc.*, 66, pp. 22–26, 1954.

A detailed comparison of the physical condition and distribution of feeder roots of iron-deficient, iron chelate-treated, and non-deficient orange trees on rough lemon rootstock in 15 groves in Florida showed that soil applications of iron, chelated with ethylenediamine tetra-acetic acid, to iron-deficient citrus trees [cf. *R.A.M.*, 35, p. 234] resulted in a significant increase in feeder roots. In general, chelated iron increased root growth in proportion to the degree of chlorosis originally present, and gave a rapid development of new feeder roots when the soil pH allowed such roots to survive.

Grant (T. J.). **Aids in the detection of tristeza in Florida Citrus.**—*Proc. Fla hort. Soc.*, 66, pp. 69–73, 1954.

While studying the spread of tristeza virus in the field in Florida it was found that vein-clearing symptoms on Persian (Tahiti) limes often indicated the presence of the disease, confirmation being obtained by grafting to Key [West Indian] lime. Occasional instances of vein-clearing on limequats and Meyer lemon were less conclusive. It was also found possible to detect small vein-cleared dashes on the lateral veins of young sour orange and Duncan grapefruit leaves, which symptoms, though disappearing as the leaves matured, enabled the presence of the tristeza virus to be diagnosed by subsequent confirmatory Key lime grafts.

Top-working of citrus to new varieties incurs the danger of introducing virus diseases. In California [*R.A.M.*, 32, p. 622] complete top-working of quick decline-infected Valencia orange on sour orange rootstock with acid lemon was successful (though only partial top-working was not), but the success of this procedure has yet to be judged in Florida, where the effect of the possible presence of virus diseases other than tristeza has to be taken into account.

Chowdhury (S.). **Citrus sooty moulds in Assam.**—*Sci. & Cult.*, 21, 3, pp. 164–165, 1 fig., 1955.

Investigations by the Plant Pathological Laboratory, Jorhat, Assam, showed that sooty moulds are present in most citrus orchards in the State, all citrus species being equally affected. The following fungi, in descending order of frequency, were isolated from a large number of specimens collected in different parts of the State:

Capnodium citri [*R.A.M.*, 30. p. 263], *Meliola butleri* [cf. 19. p. 617], *Cladosporium herbarum*, and *Acrothecium lunatum* [*Curvularia lunata*]. Spraying once a month with a suitable pesticide controlled the disease by checking the insects on whose excreta the moulds flourish.

Ciferri (Fiorella). **Tassonomia e nomenclatura dell' agente del 'marciume acido' dei frutti di Agrumi.** [The taxonomy and nomenclature of the agent of 'sour rot' of Citrus fruits.]—*Ann. Sper. agr.* N.S. 9, 1, pp. 5–10, 1955. [English summary.]

In a study at the Italian Cryptogamic Laboratory, Pavia, and the Institute of Plant Pathology, Milan, of strains of *Oospora citri-aurantii* [cf. *R.A.M.*, 33. p. 479] associated with sour rot of citrus fruits, mostly from Reggio Calabria, the fungus causing the disease was identified as a variety of *Geotrichum candidum*, and accordingly *O. citri-aurantii* is renamed *G. candidum* var. *citri-aurantii* (Ferr.) R. Cif. & F. Cif. n. comb. The variety differs from *G. candidum* only in its ability to grow at low pH values, as in lemon juice.

Childs (J. F. L.). **Observations on Citrus blight.**—*Proc. Fla hort. Soc.*, 66, pp. 33–37, 1953. [Abs. in *Biol. Abstr.*, 28, 11, p. 2687, 1954.]

Citrus blight [*R.A.M.*, 15. p. 796] is estimated to cost Florida $1,400,000 annually. Species of *Phoma*, *Diplodia*, and *Fusarium* have been isolated regularly from the roots of affected trees, but in pot tests they caused typical leaf blight only on seedlings previously weakened. The xylem vessels of the roots and branches of blighted trees regularly contained plugs of unidentified material. A species of *Nocardia* was isolated from the roots on a number of occasions.

Vaheeduddin (S.). **Rust on Grapefruit.**—*Curr. Sci.*, 24. 10. p. 345, 1 fig., 1955.

Uredo citri n.sp. caused severe leaf infection and defoliation of grapefruit in March, 1951, in the Nizamabad District, Hyderabad State, India. The echinulate uredospores measure 14·5 to 20 by 10 to 18 μ.

Crandall (B. S.) & Arellaga (J. G.). **A new Rhizoctonia from El Salvador associated with root rot of Coffee.**—*Mycologia*, 47. 3. pp. 403–407, 2 figs., 1955.

Three distinct root diseases of *arabica* coffee are present in Salvador: black root rot [*R.A.M.*, 30. p. 36]; a *Fusarium* rot with which *Rhizoctonia* [*Corticium*] *solani* is associated; and one due to *Helicobasidium compactum* [cf. 31. p. 399]. All three attack the host at any age, susceptibility apparently being due partly to nutritional trouble.

Trees affected by black root rot often die rapidly, usually with the leaves still attached, or the decline may be slow and loss of leaves gradual. A conspicuous swelling is generally present above the collar, and the root is covered with an incrustation of soil held to it by an exudate from the tree and by hyphae of *C. solani*: the perfect state is often produced. Another *R.* sp. occurs in the smaller rootlets and in the xylem and phloem of the trunk, often to a height of a foot or more above ground level. It is considered to be a new species, and is named *R. choussii*. In culture, aerial growth is sparse: the vegetative hyphae on and in the media are colourless to buff, measuring 6·25 to 9·5 μ in diameter, occasionally thickening to 13 μ. The lateral branches, characteristically constricted at the point of union, with a septum usually at a distance of 25 μ, often grow at right angles, but generally at 45° to 50°, curving and finally running parallel to the parent hyphae. Sporodochia are not formed. The pseudospores, in branched, moniliaceous chains of 3 to 20, (mostly) measure 8·3 to 11·2 by 16·5 to 19·5 μ.

The fungus is of the mycorrhizal type, probably becoming parasitic under certain conditions.

While it was not possible to reproduce black root rot by direct inoculation, healthy trees transplanted into inoculated soil regularly contracted the disease. Of the cover-crops regularly used with coffee, *Crotalaria vitellina*, *Desmodium nicaraguense*, and *Leucaena glauca* were highly susceptible. *C. vitellina* is regularly found in affected coffee plantings.

Franco (C. M.) & Mendes (H. C.). **Deficiência de zinco em Cafeeiro.** [Zinc deficiency in the Coffee bush.]—*Bol. Suptda Serv. Café, S. Paulo*, 29, 334, pp. 34–39, 2 figs., 1954. [English summary. Received January, 1956.]

Symptoms of zinc deficiency in coffee in São Paulo, Brazil [cf. *R.A.M.*, 33, p. 536] occur principally in plantations on red soils and include shortening of the internodes, reduction in size of leaves and fruits, and chlorosis, accompanied in severe cases by die-back. In experiments at the Agronomic Institute, Campinas, a more or less complete cure was effected by one application of a zinc sulphate spray at a dosage of 6 gm. per l., preferably at the end of September.

Lagière (R.). **Dommages causés par la foudre dans les plantations de Cotonniers.** [Damage caused by lightning in Cotton plantations.]—*Cot. et Fibres trop.*, 10, 1, pp. 55–58, 2 figs., 1955.

In the course of a phytosanitary inspection of the cotton plantations in the Oubangui-Chari territory, French Equatorial Africa, at the beginning of December, 1948, the writer observed in 14 fields circular patches, 5 to 25 m. in diameter, of dying or dead plants with fawn-coloured, desiccated, brittle leaves insecurely attached to the branches by their dead petioles. The stems were greyish-black, and at a height of 15 to 20 cm. above soil-level the pith was in fragments and often cracked. At the periphery of the patches, where the symptoms were milder, they were observed to start at the top of the plant and proceed downwards.

The results of inoculation experiments with the fungi isolated from affected plants, i.e., *Botryodiplodia theobromae*, *Fusarium bulbigenum*, *F. oxysporum*, *F. javanicum* var. *radicicola*, and *F. scirpi* var. *caudatum* [*R.A.M.*, 32, p. 186], were inconclusive, and the injury is attributed to the action of lightning [cf. 22, p. 305].

Drechsler (C.). **Additional species of Zoopagaceae subsisting on rhizopods and eelworms.**—*Mycologia*, 47, 3, pp. 364–388, 9 figs., 1955.

Descriptions are given of eight new species belonging to the Zoopagaceae and of a related form of uncertain specific identity, all except two found capturing and subsisting on amoebae or eelworms in decaying vegetable matter from Louisiana, Maryland, New Jersey, and Wisconsin [cf. *R.A.M.*, 30, p. 466; 34, p. 596, *et passim*].

Evlahova (Mme A. A.). Развитие гриба **Empusa grylli (Fres.) Nowak** в теле итальянской Саранчи. [The development of the fungus *Empusa grylli* (Fres.) Nowak in the body of the Italian Locust.]—Микробиология [*Microbiology, Moscow*], 23, 2, pp. 185–189, 1 pl., 1 fig., 1954.

At the Pan-Soviet Scientific Research Institute of Plant Protection, Leningrad, histological and microscopic studies, based on the observations made in Moldavia in 1947 and at Krasnodar in 1949, showed that Italian locusts (*Calliptamus italicus*) in the first stages of infection with *Empusa grylli* [*R.A.M.*, 29, p. 89] appear healthy and normal. The multiplying mycelial bodies of the fungus produce a fermentative disintegration of the blood cells and of the fat and muscle tissues, ultimately killing the locust. The elongated, mycelial forms begin growing only after the death of the host and cause the formation of conidiophores, which appear as a velvet coating on the surface of the insect. The formation of the quiescent spores in the body of the locust is regarded as essential to the life-cycle of the fungus.

HART (MARY P.) & MACLEOD (D. M.). **An apparatus for determining the effects of temperature and humidity on germination of fungous spores.**—*Canad. J. Bot.*, 33, 4, pp. 289–292, 1 fig., 1955.

At the Laboratory of Insect Pathology, Sault Ste. Marie, Ontario, an apparatus was constructed for distributing fungus spores evenly on slides and incubating them under accurately controlled conditions. A glass spore container 2½ by 1⅝ in., with a rubber stopper and four glass outlet jets 0·8 mm. in diameter, was suspended in a cylindrical, cellulose-acetate dusting chamber 12 by 16 in. A fifth tube passing through the centre of the stopper was connected to an air reservoir from which air at 5 lb. per sq. in. entered the spore container and forced the spores through the four outlet jets into the cylinder, enabling 30 slides to be dusted at once.

Spores of four morphologically distinct strains of *Beauveria bassiana*, two from *Pristiphora erichsonii* and two from *Carpocapsa pomonella*, were dispersed on sterile dry slides and germinated in airtight Petri dishes in which a relative humidity of 94 to 100 per cent. was maintained by means of sulphuric acid and checked by thermocouples inserted through the lid. Germination increased with humidity [cf. *R.A.M.*, 33, p. 496]; at 94 per cent. relative humidity it was very low, but as the humidity increased temperature became the controlling factor. Germination was at a maximum at 28° C., slightly less at 25°, and negligible at 10° and 38°.

MAJUMDER (S. K.), MUTHU (M.), & PINGALE (S. V.). **A bacterial disease of Heliothes obsoleta F.**—*Curr. Sci.*, 24, 4, pp. 122–123, 3 figs., 1955.

An unknown bacterium is reported to be killing caterpillars of *Heliothes obsoleta*, which attacked the *Dolichos lablab* crop severely in 1953 and 1954 around Mysore, India. The possibility of using this bacterium for the control of the insect is considered.

WIERSEMA (H. T.). **Flax scorch.**—*Euphytica*, 4, 3, pp. 197–205, 5 figs., 1955. [Dutch summary.]

Studies at the Foundation for Agricultural Plant Breeding, Wageningen, Holland, revealed no physiologic specialization among isolates of the flax scorch fungus, *Pythium megalacanthum* [*R.A.M.*, 18, p. 268]. The variety Verum was highly resistant and Liral Crown highly susceptible. Accordingly, further efforts were made to determine varietal reaction, the best method, for use in spring and summer only, consisting of sowing the seed in flats of steamed soil, and mixing the inoculum (five-day-old cultures on maize meal or oatmeal agar) with the bottom layer. At soil temperatures of 14° and 19° C. differences in resistance were clearly visible. As the susceptible plants were either killed when young or stunted only plants of normal length were harvested. After two or three years of this mass selection most of the susceptible plants were eliminated and single plant selection began. The resistant variety Noblesse was selected from a cross between Concurrent (susceptible) and Hercules (moderately resistant).

In tests of the resistance of several well-known varieties rated on a scale from 10 (highly resistant) to 1 (highly susceptible), Verum scored 9, Hylkema 1871 and Diana 8½, Noblesse 8, Hercules 7, Wiera 6½, and Corvallis 6.

BUXTON (E. W.). **Fusarium diseases of Gladiolus.**—*Trans. Brit. mycol. Soc.*, 38, 3, pp. 193–201, 1 pl., 1 fig., 1955.

Isolates of *Fusarium* of the Elegans section cause two major types of disease in gladiolus. One, a rot of stored corms, is of long standing in Britain [*R.A.M.*, 33, p. 230]; the other, probably identical with the North American *Fusarium* yellows, has only recently been recorded here [loc. cit.; 33, p. 724], but is widespread in nearly all commercial stocks of susceptible varieties. In America the two diseases

are regarded as etiologically distinct, corm rot being attributed to *F. oxysporum* var. [f.] *gladioli* [34. p. 787] and yellows to *F. orthoceras* var. *gladioli* [23. p. 345]. However, this does not seem to be the case in Britain. At the Botany School, University of Cambridge, *Fusarium* spp. isolated from rotting corms caused yellows in growing plants, and isolates from yellowed plants rotted corms in storage. Whether different isolates caused yellows or corm rot, both, or neither depended on the gladiolus cultivar to which they were inoculated. Corms that resisted invasion by some isolates formed cambial tissues and cork barriers.

From the marked similarity between the pathogenic properties and taxonomic characters of the different isolates it is concluded that they should all be classified as *F. oxysporum* f.sp. *gladioli* [see next abstracts].

Buxton (E. W.). **The taxonomy and variation in culture of Fusarium oxysporum from Gladiolus.**—*Trans. Brit. mycol. Soc.*, 38. 3. pp. 202–212. 1 pl., 2 figs., 3 graphs, 1955.

In studies at the Botany School, University of Cambridge, variations in light intensity, nitrogen concentration, and pH of the culture medium affected the morphological features of some 50 isolates of *Fusarium* of the Elegans section, isolated from diseased gladiolus [see preceding abstract], to such an extent that they could no longer be used as reliable taxonomic criteria. The wide range of morphological expression in culture demonstrated that the British isolates included the taxonomic descriptions hitherto applied to species from plants showing premature leaf-yellowing (*F. orthoceras* var. *gladioli*) and storage rot of the corms (*F. oxysporum* var. [f.] *gladioli*). The changes in spore shape, size and mode of presentation, colony colour, and type of aerial mycelium, were sufficiently wide to necessitate placing all the isolates in the macro-species *F. oxysporum* sensu Snyder & Hansen [*R.A.M.*, 21. p. 215], and it is suggested that the agents of premature leaf-yellowing and storage rot of the corms both be classified as *F. oxysporum* f. sp. *gladioli*.

Buxton (E. W.). **Chalky dry rot of Freesia corms.**—*Plant Path.*, 4. 2. pp. 69–70. 1955.

In 1953 the author isolated *Fusarium oxysporum* from freesia corms received from the National Agricultural Advisory Service, Cambridge, showing the symptoms of chalky dry rot described in America in 1933 [*R.A.M.*, 13. p. 101]. Potted plants of the Maryon and Beauty varieties of freesia were subsequently inoculated with two cultures of *F. oxysporum* f. *gladioli* from diseased gladiolus corms and three of *F. oxysporum* from diseased freesia corms [cf. preceding and next abstracts]. The plants grew for some five months, many of them becoming yellowed, and the inoculated corms were then lifted and stored for six months, when it was found that corms from all the plants whose foliage had become prematurely yellow yielded *F. oxysporum*. Chalky dry rot had developed in the corms inoculated with isolates obtained from chalky freesia corms and, to a less extent, from those not originally chalky, but not in corms inoculated with isolates from gladiolus. The results suggest that *F. oxysporum* can be considered to be one cause of chalky dry rot of freesia corms in Britain and that different freesia varieties vary in their susceptibility to different isolates of *F. oxysporum*. Inoculations of freesia plants with *F. oxysporum* f. *cubense* from bananas were unsuccessful, though the isolate was indistinguishable in culture from other isolates pathogenic to freesia.

Bruhn (C.). **Untersuchungen über die Fusarium-Krankheit der Gladiolen (Erreger: Fusarium oxysporum Schl. f. gladioli (Massey) Snyder and Hansen).** [Studies on the *Fusarium* disease of Gladioli (agent: *Fusarium oxysporum* Schl. f. *gladioli* (Massey) Snyder & Hansen).]—*Phytopath. Z.*, 25. 1. pp. 1–38. 9 figs., 1955.

The losses caused annually in the nurseries of Berlin and Western Germany by

Fusarium oxysporum f. *gladioli*, which has now been present in the country [cf. *R.A.M.*, 33, p. 725] for some years, are estimated at an average of 30 per cent. of the gladiolus crop, equivalent to DM. 1,300,000. Of the 32 strains of *F. o.* f. *gladioli* isolated from diseased roots, corms, and leaf bases, only 12 were strongly and 5 weakly pathogenic to gladiolus. Inoculation experiments on *Acidanthera bicolor*, *Crocus aureus*, hybrid freesia, *Iris hollandica*, *Lapeyrousia cruenta*, and *Tritonia crocosmiiflora* also gave positive results. Strains of the fungus were also isolated from naturally infected *C. aureus*, freesia, and *T. crocosmiiflora*. The isolate from *C. aureus* was pathogenic to gladiolus, that from freesia to *A. bicolor*, *C. aureus*, and gladiolus, and the one from *T. crocosmiiflora* to *A. bicolor*, *C. aureus*, freesia, and gladiolus [see preceding abstract].

Infection originated primarily in the corms and careful sorting at harvest time is the basis of control. Conspicuous differences between healthy and diseased plants are apparent as an aid to differentiation. However, since even externally sound corms may harbour conidia, all planting material should be disinfected, e.g., with mercurial solutions or dusts, formalin, or ferbam, though none of the preparations tested gave adequate control in cases of severe infection. A period of four years should elapse before gladioli are replanted on a site already occupied by the same crop or other susceptible Iridaceae. Of the 38 gladiolus varieties tested for reaction to *F. o.* f. *gladioli* only Hopmans Glory, Mrs. Marks Memory, Pactolus, Palet, Cardinal Spellman, and Lilac Wonder gave any significant indications of resistance. Breeding for resistance, though theoretically possible, would probably be too complicated for profit.

Müller (E.) & Menon (R.). **Über Venturia rosae de Not. und die Nomenklatur der Gattung Venturia de Not.** [On *Venturia rosae* de Not. and the nomenclature of the genus *Venturia* de Not.]—*Phytopath. Z.*, 25, 2, pp. 190–195, 2 figs., 1955. [English summary.]

The original type material of *Venturia rosae* appears to have been lost, but in June, 1955, the species was collected on dead twigs of *Rosa alpina* in the canton of Glarus, Switzerland, and in the following August in the Hautes Alpes, France. In order to avoid the confusion which would arise from a strict application of the rules of nomenclature, it is proposed to include the two generic names, *Venturia* de Not. (emend. Sacc.) with the lectotype *V. inaequalis* (Cke) Wint. and *Gibbera* Fr. [*R.A.M.*, 34, p. 402], represented by *G. vaccinii* Fr., in the list of 'Nomina Generica Conservanda'. *V. rosae* should henceforth be known as *G. rosae* n. comb.

The species appears to be parasitic, producing extensive, blue-grey lesions on living rose twigs. The hyaline or faintly brownish hyphae can be seen in epidermal sections and often in the cortical tissues. The diseased twigs die off and the perithecia develop in the following spring on the blue-grey portions of the cortex.

Jones (W.). **Foot rot of Wallflower caused by Phytophthora megasperma.**—*Canad. J. Bot.*, 33, 6, pp. 531–533, 1 pl., 1955.

In March, 1953, a number of overwintered wallflower plants in Saanichton, British Columbia, were attacked by a foot rot, turning the leaves pale green or whitish and causing them to fall. Some roots were necrotic and all the stems of affected plants were rotted. *Phytophthora megasperma* [*R.A.M.*, 35, p. 160] was found in the diseased tissue. The winter preceding the outbreak was abnormally mild and wet; the fungus was shown to be pathogenic to wallflower only under very wet soil conditions. A stem rot of cabbage in a field adjacent to the outbreak was shown to be due to the same pathogen.

Hollings (M.). **Aspermy virus and flower distortion in Chrysanthemums.**—*J. Minist. Agric.*, 62, 6, pp. 275–277, 1 pl., 1955.

Flower distortion has become increasingly prevalent in chrysanthemums in the

United Kingdom in recent years and is mainly due to virus disease, principally tomato aspermy virus [cf. *R.A.M.*, 35, p. 18]. All chrysanthemum varieties tested have proved susceptible, the Favourite, Harrison, and Sweetheart groups, especially the latter, being particularly affected.

Only chrysanthemum, tomato [29, p. 180], China aster, and zinnia have so far been found naturally infected. Sow thistle [*Sonchus* sp.], groundsel [*Senecio vulgaris*], black nightshade [*Solanum nigrum*], and wall lettuce (*Lactuca muralis*) have been experimentally infected, but no natural infections have been found on weeds; a number of ornamentals are highly susceptible.

Young cuttings infested with aphids are the main source of infection: hence aphid control in spring is important. Normal handling causes little harm, but root contact between several plants in one large pot can spread infection.

Much of the information concerning aspermy virus is equally applicable to the control of other chrysanthemum virus diseases [30, p. 331], of which virus b at least is known to be aphid-transmitted. Plants affected by leaf-mottling viruses are best rogued in spring when the symptoms show clearly.

Brenchley (G. H.) & Johnstone (Katherine H.). **Grey mould of Anemones in Cornwall.**—*Plant Path.*, 4, 2, pp. 54–57, 1955.

Out-of-season cultivation of anemones in Cornwall, and to a lesser extent Devonshire, leads to serious damage by grey mould (*Botrytis cinerea*) [*R.A.M.*, 29, p. 304]. The close planting and nitrogenous manuring necessary to secure a satisfactory crop, together with the mechanical damage caused during cultural operations and in picking, all predispose the plants to attack under conditions favouring the fungus, which is often concerned in a rot accompanying the general condition of debility known as 'winter browning' [30, p. 14].

None of the predisposing causes is likely to be followed by an epidemic outbreak unless the weather favours infection. The disease is rarely serious before October or after January. The worst recent epidemics (1948, 1951, 1953) occurred when gales in September were followed in October by warm periods of high atmospheric humidity.

To reduce infection, windbreaks, living or non-living, are essential. Good results have followed balancing nitrogen with heavy applications of potash, especially when the former is given in lasting form, such as coarse hoof-and-horn. The concentration of inoculum, increased by the proximity of other highly susceptible crops such as strawberries, cannot be effectively reduced in practice. Dusting with tetrachloronitrobenzene was ineffective.

Although certain cultural practices may help to reduce infection, the risk of attack by *B. cinerea* must be accepted by those who wish to obtain anemones of the highest quality; if an epidemic occurs, there is at present no satisfactory method of checking it.

Keller (J. R.) & Shanks (J. B.). **Poinsettia root rot.**—*Phytopathology*, 45, 10, pp. 552–558, 3 figs., 1955.

The root rot of greenhouse-grown poinsettias [*Euphorbia pulcherrima*] described in this contribution from the Departments of Botany and Horticulture, University of Maryland, comprises two phases. The first, caused chiefly by *Rhizoctonia* and *Pythium* spp. [cf. *R.A.M.*, 30, p. 611], develops when cuttings are rooted. The second takes the form of a late-season rot, appearing just before the plants are ready for the Christmas market. At this stage *Thielaviopsis basicola* [35, p. 191] is the primary agent of infection, but root injury is increased by the simultaneous presence of *R.* and *P.* spp.

In cross-inoculation experiments two isolates of *T. basicola* from poinsettia (one each from Maryland and New York) and two from tobacco, a brown and a grey

[loc. cit.], were pathogenic only to their own hosts. The Maryland poinsettia and the brown tobacco strains were more virulent than the other two, and the virulence of the isolate used appeared to be the major factor affecting the development of the disease. Virtually no injury from *T. basicola* occurred in soil maintained at a pH below 5, whereas at 6·3 and 7·3 damage was heavy. A greenhouse night temperature of 70° F. retarded but failed to prevent root rot development, which was promoted at 60° F. and below and also by the high soil-moisture level achieved by watering 29 times in 35 days. Of the 11 varieties of poinsettia included in the tests, Pink and St. Louis were the most, and the Indianapolis Reds the least susceptible.

Gokhale (V. P.), Thirumalachar (M. J.), & Patel (M. K.). **Endophyllum species on Elaeagnus latifolia.**—*Curr. Sci.*, 24, 4, pp. 125–126, 1955.

Germination studies at the Agricultural College, Poona, India, indicated that *Aecidium elaeagnilatifolia* (Monographia Uredinearum, 4, p. 164, 1924) on *Elaeagnus latifolia* is a species of *Endophyllum* and the new combination *E. elaeagni-latifoliae* is made.

Zanardi (D.). **La Claviceps purpurea sulle Graminacee.** [*Claviceps purpurea* on Graminaceae.]—*Ital. agric.*, 92, 4, pp. 273–276, 9 figs., 1955.

Meteorological conditions during the spring of 1954 in the vicinity of Pavia, Italy, were exceptionally favourable for the development of *Claviceps purpurea* [*R.A.M.*, 34, p. 574], which was observed causing 50 per cent. infection on *Agropyron repens*, 30 on *Brachypodium pinnatum*, 20 on *Dactylis glomerata* and *Festuca rubra*, 10 on *Lolium perenne*, *Bromus erectus*, and rye, 5 on *Phleum pratense* and *Briza media* (the latter a new host for the country), and 3 on wheat.

Garren (K. H.). **Disease development and seasonal succession of pathogens of White Clover. Part II—stolon diseases and the damage-growth cycle.**—*Plant Dis. Reptr*, 39, 5, pp. 339–341, 2 diags., 1955. [Multilithed.]

In further studies in this series at the Department of Botany and Plant Pathology, Alabama Polytechnic Institute, Auburn [cf. *R.A.M.*, 34, p. 154], 50 per cent. or more of the isolates from damaged stolon tissue of white clover were *Fusarium* spp. and *Rhizoctonia* [*Corticium*] *solani*, causing, respectively, 40 per cent. of the defoliation observed in late September and 30 per cent. of that in late August. *Sclerotium bataticola* [*Macrophomina phaseoli*], *S. rolfsii*, *Alternaria tenuis*, *Curvularia trifolii*, *Colletotrichum graminicola*, and *Pythium* spp. were isolated less frequently. The peak period for the last three was in November and December. Cold-induced debility proved to be a minor factor in stolon damage.

Groves (J. W.) & Bowerman (Constance A.). **Sclerotinia borealis in Canada.**—*Canad. J. Bot.*, 33, 6, pp. 591–594, 1 pl., 1 fig., 1955.

A number of different grasses in the experimental plots at Prince George, British Columbia, were severely injured by a sclerotium-forming snow mould in 1951, later determined to be *Sclerotinia borealis* [*R.A.M.*, 35, p. 192] from apothecia developed in culture. The fungus was shown to be homothallic and self-fertile.

Ozanne (P. G.). **The effect of nitrogen on zinc deficiency in subterranean Clover.**—*Aust. J. biol. Sci.*, 8, 1, 47–55, 3 graphs, 1955.

In sand- and water-culture trials carried out at the University of Western Australia, Nedlands, subterranean clover (*Trifolium subterraneum*) plants (Dwalganup strain), growing in a soil low in zinc [cf. *R.A.M.*, 33, p. 300], displayed increased severity of zinc deficiency symptoms when the nitrogen supply was increased. This effect was produced by sodium nitrate, L-asparagine, ammonium nitrate, and ammonium sulphate. It was not due to changes in soil pH or to

increased growth demand arising from the applied nitrogen. With low zinc supply the zinc concentration in the roots was correlated with the percentage of protein nitrogen present. The proportion of total zinc absorbed that was translocated to the tops was also related to the percentage protein nitrogen in the roots. It is concluded that increasing the available nitrogen causes more of the absorbed zinc to be retained by the roots in a poorly dissociated zinc-protein complex. With a low zinc supply, this increased root retention is able to cause severe symptoms of zinc deficiency in the plant tops.

PUTT (E. D.) & ROJAS EMILIO (M.). **Field studies on the inheritance of resistance to rust in the cultivated sunflower (Helianthus annuus L.).**—*Canad. J. agric. Sci.*, 35, 6, pp. 557–563, 1955.

At the Experimental Station, Morden, Manitoba, and the Agricultural Experiment Station, La Molina, Peru, field resistance to rust (*Puccinia helianthi*) in the sunflower line 953–102–1–1–22, selected from the natural cross California Oilseed × Texas Wild Annual [*R.A.M.*, 34, p. 652], was shown to be dominant and inherited on a monofactorial basis in crosses with three susceptible lines.

HÅRDH (J. E.). **Omenarupi ja sen torjunta Suomessa.** [Apple scab and its control in Finland.]—*Valt. Maatalousk. Julk.* 144, 34 pp., 5 figs., 1 graph, 1 map, 1955. [English summary.]

Studies on the biology of the apple scab fungus (*Venturia inaequalis*) from 1947 to 1954 at the Agricultural Research Centre, Tikkurila, Finland [*R.A.M.*, 16, p. 189], were concerned primarily with the time of ascospore discharge and the correlation of infection periods with meteorological conditions. At the same time experiments were performed to determine the relative efficiency of various fungicides in the control of the disease, using both the phenological spraying programme and the spray-timing method of Mills and La Plante (*Ext. Bull. Cornell agric. Exp. Sta.* 711, pp. 1–160, 1951) [cf. next abstract].

Under Finnish conditions the pathogen overwinters on fallen leaves, and the ascospores produced by the abundant perithecia are the principal source of primary infection in the spring. During the period from 1949 to 1954 the dates for the initial, main, and final ascospore discharges ranged from 28th April to 21st May, between 8th and 10th May to between 25th May and 4th June, and 4th June to 3rd July, respectively. Although ground treatments with elgetol [*R.A.M.*, 25, p. 348 *et passim*] completely inhibited ascospore discharge from the fallen leaves in 1949, 1952, and 1953, this method of control is regarded as impracticable in Finland, partly because the ascospores are carried by the wind over long distances and also on account of the prohibitive cost of the DNC preparations on sale in the country.

A schedule comprising two applications of lime-sulphur and Bordeaux mixture gave effective control of scab but frequently caused severe damage to the trees. Zineb proved superior to ferbam but did not equal lime-sulphur, while the efficacy of aapirol (thiram) seems to depend on the weather, adequate protection being conferred only in seasons of light rainfall and high temperatures, when the incidence of infection is low. The poor fungicidal action of micronized sulphur and dithiocarbamates in Finland, as compared with countries with a warmer spring, is tentatively attributed to the insufficient formation of hydrogen sulphide during the cool weather of the primary infection period. Captan seems to be the best of the protective fungicides so far tested, its efficiency being independent of temperature; it is, moreover, non-phytotoxic and in 1954 cost only half as much as lime-sulphur.

Experiments to determine the practicability of the spray-timing method [cf. 22, p. 254; 27, p. 426] under Finnish conditions were performed with the aid of 22 collaborators in southern districts, who made observations on ascospore discharge, weather conditions, and infection periods. When the timing was correct, satis-

factory control was accomplished by five to seven applications (two or three in low-rainfall areas) during the primary infection period, using captan as a protectant and the mercurials aaventa [33, p. 33], femma, and murfixtan as eradicants. In one orchard excellent results were obtained with a mixture of 0·2 per cent. captan and 0·06 per cent. femma. Susceptible varieties like Lobo, Melba, and Rupert evidently required a supplementary treatment in August to prevent late infection. On the whole, the directions of Mills and La Plante for the determination of infection periods appear to be applicable in Finland.

There was no diminution in fruit set as a result of the treatments, and in 1954 the apple varieties commonly cultivated sustained no damage. The mercurials did, however, injure Dolgo and Pedro, grown in Finland for experimental purposes only, and were also phytotoxic to plum trees, some gooseberry varieties, and *Symphoricarpus* interplanted with the apples.

Het schurftonderzoek in 1953 en 1954 (I), (II). [Scab research in 1953 and 1954 (I), (II).]—*Meded. Dir. Tuinb.*, 18, 3, pp. 129–151, 7 figs., 1 graph; 5, pp. 297–324, 9 graphs, 1955.

This symposium of research on apple and pear scab (*Venturia inaequalis* and *V. pirina*) in Holland during 1953 and 1954 comprises the following contributions. J. J. Post (pp. 130–137) discusses the meteorological aspect of scab investigations [*R.A.M.*, 34, p. 728]; E. J. Keijer and H. P. Dijksterhuis (pp. 137–139) present observations on the life-history of the apple scab fungus in 1953 and 1954 at Zeerijp (Groningen); G. S. Roosje (pp. 138–151) describes a laboratory study on the biology and control of *V. inaequalis*; A. F. H. Besemer, H. P. Dijksterhuis, E. J. Keijer, G. S. Roosje, and W. P. N. Vlasveld (pp. 297–315) report on field experiments; D. Mulder (pp. 316–319) considers the influence of plant protectives on the tree; and J. G. Ten Houten (pp. 320–324) summarizes the results.

Of paramount importance in apple scab control is the accurate determination of the infection period, which according to Mills [see preceding abstract] is directly connected with temperature and depends on the duration of continuous wetting of the leaves and other organs. To overcome the difficulty of measuring this factor, especially at night, a rain indicator called a 'pluvioscope' was constructed at the Royal Netherlands Meteorological Institute; it records exactly the length of the rainy period. A simple Six's maximum–minimum thermometer proved to be sufficiently reliable for temperature determinations. However, to assist growers who are unable to take daily records of rainfall and temperature by these methods, regional warnings are issued by wireless when the application of eradicant sprays is indicated by local weather conditions.

Mills's findings on the correlation between temperature and the duration of wetting of the leaves on the one hand, and scab outbreaks on the other, were corroborated both in the field and in an incubation chamber. At a mean temperature of 17° to 20° C. a period of eight to nine hours' wetting is necessary for infection. No confirmation could be obtained, however, of Mills's statement that for conidial (as opposed to ascospore) infection approximately two-thirds of the wet-leaf period sufficed: in tests at the Zeeland Experiment Station the time was at least as long as that needed by the ascospores. The figures cited by Mills for the incubation period of *V. inaequalis* were also in general reinforced by those obtained in Dutch laboratory and field experiments.

The organic mercurial aaventa [33, p. 33] at a concentration of 0·1 per cent. was the best of the eradicant sprays tested, giving absolute control when applied within three days of infection. Since most organic mercury compounds are injurious to pears and to sensitive apple varieties when used at the prescribed concentrations, trials were carried out to determine the effects of lower rates. They proved to be inadequate and in some orchards were also phytotoxic. Combined with parathion

[34, p. 728] or DNB [dinitro-benzene]-thiocyanate, the mercurials were even more harmful than when used alone. Full control was also secured by the application within 24 hours of infection of a protectant spray consisting of 0·5 per cent. captan [35, p. 194] and 0·2 per cent. DNB-thiocyanate. Other effective protectants (as distinct from eradicants) were ziram, zineb, and wettable sulphur. In one post-infection test on Précoce de Trévoux pears, captan reduced the incidence of *V. pirina* from 66·3 per cent. in the untreated fruits and 30·6 in those sprayed with wettable sulphur to 6·6.

In comparative experiments by the Plant Protection Service, Wageningen, with six organic mercurials namely, aaventa, alvesco, hostakwick, 2·5 per cent. phenyl mercury chloride, and two preparations designated EC and FD, the first-named exerted the strongest protectant action, but all were effective as eradicants on application within three days of infection.

The final conclusion from these investigations is that protectant sprays are preferable to eradicants at the present time. Only when no effect from the former can be anticipated should the latter be applied.

Berend (I.). **Periodical appearance of fungus-diseases in fruits.**—*Növén. Idös. Kerdés., 1954*, 4, pp. 37–38, 1954. [Abs. in *Hung. agric. Rev.*, 4, 2, p. 11, 1955.]

From observations on outbreaks of *Fusicladium* [*Venturia inaequalis*] on apple [? in Hungary] the author suggests that viability and pathogenicity of the fungus increase during dry years, resulting in an epidemic at the beginning of a wet period, whereas changes within the host plant during humid years tend to check the spread of the pathogen.

Woodbridge (C. G.). **Magnesium deficiency in Apple in British Columbia.**—*Canad. J. agric. Sci.*, 35, 4, pp. 350–357, 3 pl., 1955.

Magnesium deficiency in apples is reported to be widespread in the interior fruit-growing areas of British Columbia, Canada [*R.A.M.*, 30, p. 16]. In some orchards there is only occasional leaf blotch, while in others, severe defoliation occurs and few apples reach maturity. One to eight spray applications, depending on the severity of the symptoms, of 2 per cent. magnesium sulphate corrected the disorder. Leaf blotch was absent when the magnesium content of leaves was above 0·26 per cent. Of the apple varieties grown in the area, Jubilee and Newton were the most susceptible.

Jenkins (J. E. E.) & Storey (I. F.). **Star cracking of Apples in East Anglia.**—*Plant Path.*, 4, 2, pp. 50–52, 1 pl., 1955.

During the years 1951 to 1953 the presence was noted in fifteen apple orchards in East Anglia of isolated trees or groups of trees in an unthrifty state. The affected trees come into growth late in spring, and produce only a few flowers and mature fruits, so that the branches of severely affected trees tend to be abnormally upright. In trees which make good leader growth the latter dies back during the winter, and this is followed by the development of buds lower down the shoot and the production of shoots from buds arising at unusual places on wood of all ages, so that by late summer the trees present a profuse development of young shoots. Blister-like lesions often form on the one-year-old wood and frequently develop round the buds and roots. The affected area has a sharp margin, and the bark covering it, which may be blistered, later disappears. These bark lesions persist on the older wood.

Characteristic 'star crack' markings were observed on the fruits of every affected tree examined in one orchard in the autumn of 1954. In addition, trees showing the same fruit condition were found in other orchards, but in only a few was die-back of the leader growth present. Most of the trees were Cox's Orange Pippin, and severely affected fruits were small and distorted, with deep cracks on the sides. Most affected fruits of this variety, however, were of normal size and not distorted,

the cracks being chiefly round the calyx end. Fruit symptoms were also seen on Early Victoria (syn. Emneth Early), Charles Ross, Laxton's Fortune, and Monarch.

Observations in two orchards suggested that the trouble was transmitted with the graft wood; the distribution in a third suggested spread from tree to tree, natural grafts, due to the tying together of branches of adjoining trees, forming the means of transmission.

The star cracking recently reported from Norway by Ramsfjell [cf. *R.A.M.*, 32, p. 62] probably resembles the condition found in England. The authors do not dispute Ramsfjell's view that a virus related to false sting [20, p. 213] may be responsible, and possibly false sting, green crinkle [26, p. 230], star cracking, proliferation disease [34, p. 598], and witches' broom [35, p. 196], even if not due to one and the same virus, may have some part of a virus complex in common.

LINDNER (R. C.), KIRKPATRICK (H. C.), & WEEKS (T. E.). **Some factors affecting the purification of a stone fruit virus.**—*Phytopathology*, 45, 10, pp. 574–576, 1 graph, 1955.

At the Tree Fruit Station, Wenatchee, Washington, a stone fruit virus designated PLMV, which is mechanically transmissible to Chicago Pickling cucumber [*R.A.M.*, 34, p. 344], has been partially purified by differential centrifugation. It is very unstable, being denatured by heat, high salt concentrations, oxidation, and acids. Even in a semi-purified state it loses its infectivity in a few weeks at 40° F. The electrophoretic mobility of the virus in a buffer of 0·02 M neutral potassium phosphate plus 0·15 M potassium chloride is $6{\cdot}7 \times 10^{-5}$. Its concentration in cucumber tissue approximates to 50 p.p.m. of the fresh weight. Complete purification of the virus has hitherto proved impracticable, the preparations being still heavily contaminated with large cytoplasmic inclusions.

CIFERRI (R.), RUI (D.), SCARAMUZZI (G.), & CANDUSSIO (R.). **La 'leptonecrosi' nutrizionale del Pesco. Parte I.** [Nutritional 'leptonecrosis' of Peach. Part I.]—*Ann. Sper. agr.*, N.S., 9, 1, pp. 45–76, 26 figs., 1 map, 1955. [English summary.]

A detailed description is given of the external and internal symptoms of non-parasitic leptonecrosis of peach trees [*R.A.M.*, 34, p. 731] in Italy. Two forms of the condition are distinguished, a slow one, in which death occurs a year or more after the first appearance of the symptoms, and a rapid one, described as of the 'apoplectic' type [cf. 10, p. 529], in which death may take place in a few weeks. No causal organism has so far been found.

BEREND (I.). **The most important diseases of Apricot-trees.**—*Növén. Idös. Kerdés.*, *1954*, 4, pp. 39–41, 1954. [Abs. in *Hung. Agric. Rev.*, 4, 2, p. 11, 1955.]

Included among the diseases of apricots in Hungary, beside those already noticed [*R.A.M.*, 12, pp. 575, 640; 18, p. 535; 27, p. 139; 33, p. 488], are *Podosphaera* [*oxyacanthae* var.] *tridactyla*, which is of secondary importance, *Phellinus* [*Fomes*] *igniarius* [cf. 34, p. 549], and *Pseudomonas spongiosa* [*P. syringae*].

MILLIKAN (D. F.). **The influence of infection by ring spot virus upon the growth of one-year-old Montmorency nursery trees.**—*Phytopathology*, 45, 10, pp. 565–566, 1955.

The results of comparative observations in 1951 and 1953 at the Department of Horticulture, University of Missouri, between nursery-run, uncertified Montmorency cherry trees and the same clone propagated from sources certified free from ring spot virus [*R.A.M.*, 34, p. 654] demonstrated the superior vigour of the latter. Some of the strains of the virus used in inoculation experiments to investigate its potential capacity for growth depression were, however, so mild that any reduction from this source was perceptible only during the middle part of the growing season. The most conspicuous difference between infected and healthy trees was the more extensive branching of the latter, the average heights of both groups being approximately equal.

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